

PERSONAL
weekly
COMPUTER

50p February 4, 1984 No 47

NEWS

BRITAIN'S BIGGEST WEEKLY

A PCN EXCLUSIVE



FIRST



LOOK AT



SINCLAIR'S

NEW QL

CUT-PRICE DAISY

Full test of this
£299 daisy wheel printer

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Card

Number

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051-727 8050

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Name _____

Address _____

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Computers for no-one

By **Ralph Bancroft**

Computers for All, the independent distributor of hardware and software, has ceased trading leaving users and dealers high and dry.

The company acted as bulk buyer and supplier to over 50 dealers around the country who were able to use the Computers for All name and benefitted from its promotional work. But it was suffering a severe cash flow crisis that has left users, dealers and manufacturers owed large sums of money.

Hardest hit will be users who, faulty machines have been returned to the company. Not only are they unlikely to get the machines repaired but also there are doubts whether they will have their machines returned.

Some dealers are responding by offering to replace faulty machines that have been sent back to Computers for All. But it could depend on their ability to stand the financial loss.

One dealer, The Compushop in Newcastle, said that it is owed £1,600 for goods paid for but not

received, and probably twice that amount if the cost of returned machines is taken into account.

The suppliers are owed the largest sums of money. Prism, which supplied the company with

Spectrums, is owed a 'substantial amount', believed to be well into five figures and possibly more. Acorn is owed over £100,000 for BBC Bs and Electrons that have been delivered but not paid for.

A creditors meeting has been called for February 17 to consider the appointment of a liquidator.

PCN was unable to contact Computers for All's directors Jeff Weinrich and Steve Vickers.

Comx confusion in wake of collapse

One company that has its own reasons to rue the collapse of Computers for All is Comx World Operations Limited, the manufacturer of the Comx 35.

Last week Thomas Yu, Comx's general manager and director, and Ken Tracton, the firm's marketing support director, travelled from Hong Kong and sought PCN's assistance in finding Computers for All and to set the record straight about the Comx 35.

The machine, which uses an 1802 processor chip and comes with built-in joystick and 32K of RAM, was favourably reviewed by PCN in issue 15 and Comx expected it to sell well with a price tag of £120.

It appointed another Hong Kong-based company called Ger-

maine to act as its UK distributor.

The first it knew that Computers for All was distributing its machine in the UK was when it read PCN (Issue 35) that Computers for All had withdrawn the machine because of quality control problems.

It contacted Computers for All, which until then had been under the impression that Germaine was the manufacturer. The problems with the machines that Computers for All had seen were traced to two faulty ICs in the machine.

Mr Yu said that the IC manufacturer now guards against the causes of the faults. As a result machine failure rates are low. 'We have sold 4-5,000 machines in Holland and the return rate has been 0.4 per cent,' he said.

All this information was communicated to Jeff Weinrich, one of Computers for All's directors, who promised in a telex at the end of November to issue a press release to put the record straight. But PCN received no such press release and Comx has not been able to get replies to its telexes since.

Comx is now looking for a new UK distributor and is anxious to relaunch the machine.

Concerns about the lack of software support have been overcome, Mr Yu said, as the company now has a library of more than 150 programs including languages such as Pascal and Fort. It has also produced a serial/parallel interface and a 40 column thermal printer for the machine.

Lisa for less as the big Apple moves into higher gear

Along with an extravagant launch for the Macintosh last week (Issue 46) Apple announced a series of Lisas — if at first you don't succeed... The Lisa 2 series has three models, unimaginatively dubbed Lisa 2, Lisa 2/5 and Lisa 2/10. The range can run the original Lisa software and that being developed

for the Macintosh. The standard model has a single 3.5in floppy drive /5 and /10 have 5 and 10 Mb hard disks inside.

Apple says the operating system has been upgraded — this and the microdisks increase the speed of the new Lisas to 2/3 times the speed of their predecessor. That either

makes them fast or the Lisa slow — take your pick. The Lisa 2s have 512K of RAM which can be expanded to 1 Mb. They also have a 12in screen (the Mac's is 9in).

The straight 2 will be priced at £2,625, the 2/5 at £3,375 and the 2/10 at £3,135.

Not slow to recognise a potential golden goose, Microsoft has announced that it has already converted several of its products to run on the Macintosh, and hence on the rest of the Lisa range.

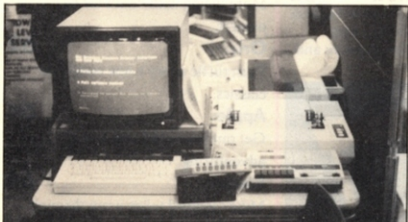
Microsoft Basic has been translated, as have other utilities and applications — MS File, Chart, Word, and Multiplan. Not all of these packages will be available immediately in the UK but the same could be said of their target machines.

This makes it an each-way bet as far as Microsoft is concerned, with its own windows on MSDOS, and PCDOS also on the file.

For a Macintosh Pro-Test see Issue 46.



Manx robots? Three Armdroids line up for inspection.



Core processing — the new Interfaced Electron amidst peripherals.

School's out

By **Geoff Wheelwright**

The robots are going to school — or, at least they will be if the interest they generated at last week's Acorn Education Show is any indication.

At least four varieties of robotic device for the BBC micro were playing to large audiences of goggle-eyed teachers at the show in Central Hall Westminster. In addition to the old favourites — the Edinburgh Turtle and the government-sponsored BBC Buggy — two relative newcomers also garnered some of the limelight.

The first of these was a Lego-like contraption called 'The Beastie' which hooks up to the BBC's user port and operates up to four servo motors. Those servos can then be hooked up to output arms which allow you to twist, turn, push, pull, lift, lower, open and close various objects. The Beastie is manufactured by Commotion (Computer Operated Motion) and sells for

£49.95 — with servo prices starting at £14.50.

The second was a similar device that isn't entirely new but still remains popular: the Armdroid Robotic Arm from Colne Robotics.

The other main draw seemed to be add-on memory and processor systems for both the BBC Micro and the Electron.

Broadway Electronics was showing a plug-in user port and printer interface card for the Electron that it hopes to have in production within a few weeks — and said it is now making plans for a disk interface system. A spokesman for the company said, although he hadn't expected there to be a big demand for Electron disk interfacing, he had received more than 60 inquiries on the subject during the few days run of the show.

The company has not yet established a price for the add-on cards. It can be reached on (0234) 58303.

Minor mishaps

By Bryan Skinner

Controversy marked the 'Golden Joystick' awards last week when the award for the Best Arcade Style Game went to Bug-Byte for its top-selling Spectrum game of 1983, Manic Miner.

Manic Miner is now also produced by Software Projects, another Liverpool company and the contract which Matthew Smith (author of Manic Miner) signed last year with Bug-Byte is now under scrutiny because of an alleged missing comma and because in law he is still a junior.

Bug-Byte told PCN that an amicable agreement had been reached. It would stop production of the games and sell its stock.

But Matthew Smith claims that Bug-Byte still owes him money from its sales of Manic Miner.

He will be 18 in February and will then be able to take a managerial position in Software Projects, which is producing the game for the Spectrum and which has just released a Commodore 64 version. This was translated by Chris Lancaster.

Though little mention was made

of authors at the award ceremony, John Philips, Bug-Byte's sales manager, did call on Matthew to share a moment's glory as he accepted the award.

The awards were presented by Dave Lee Travis and the winners were:

Best Arcade Style Game — Manic Miner

Best Strategy Game — The Hobbit
Best Original Game — Ah Diddums

Game of the Year — Jet-Pack
Software House of the Year — Ultimate Play the Game

Dragon 64 compatibility — a solution

The question of software compatibility between upgraded versions of machines with the same pedigree has raised its ugly head in the case of the Dragon 64.

Dragon 32 users who have converted to the 64 version of the machine may be experiencing problems when running their old software (transferred from the 32). Any calls that are made to the ROM when in 64 mode will probably cause the machine to crash.

The problem is that the operating system ROM, normally situated between &H8000 and &HBFFF, has been moved into RAM between &HC000 and &HFEFF, giving a totally 'soft machine'. The solution is, whenever you want to use a ROM routine, to take the old (32K) address and add to it an offset of &H4000 or 16384.

Dragon Data tells us that the majority of routines will work using the above method, but a few may not. Contact Dragon if you run into further problems — 0656 744700.

PCN prompts BBC Maltron conversion

By Piers Letcher

The Maltron keyboard (Issue 22) is now available for the BBC Micro. Software to make the Maltron fit on to the BBC was written by Jansoft after PCN put Steven Hobday, designer of the keyboard, in touch with the company following our review last August.

The keyboard offers a radical alternative to the qwerty style, which Mr Hobday says is an unnatural way to type.

The Maltron will work with all the BBC word processors, and software switching will enable you to choose between standard BBC and Maltron keyboards.

It takes about four weeks to perform the conversion, but your BBC need only be away for a few days to make the connections. The Maltron keyboard costs £200 including fitting and software, from Steven Hobday, PCD Maltron, 15



Maltron keys into Wordwise.

Orchard Lane, East Molesey, Surrey KT8 0BN. Tel 01-398 3265.

Many people find the Maltron more natural to use.

Offshore pirate in Gulf haven

By John Lettice

Abu Dhabi-based Qadan Software seems to have taken software piracy offshore. The company recently advertised QCC, a magazine on tape that apparently includes games by Ultimate and Imagine.

Imagine's first reaction to this was 'Well we're not very happy about it,' but operations director Bruce Everiss said that Imagine had already contacted the magazines carrying the ads, threatening a boycott by software companies if they continue to publish Qadan's advertising material. 'And then they'll go bust,' he added.

Imagine will also be trying to stop the tapes coming through customs, but will be confining its legal activities to this country. 'We currently have legal actions in Belgium and Spain,' says Everiss, 'and I can tell you it's a real pain.

There's no way we're going to waste our time litigating in the Gulf.'

John Cade, publisher of PCN's sister magazines Computer Answers and Personal Computer World, which published the advertisements, said Qadan's ads had already been banned. He explained that, while the magazines would never knowingly carry ads for pirated material, it was often difficult to tell it was pirated until the magazine was on the bookshelves.

So what does Qadan Software think of all this? Mr Qadan in Abu Dhabi first said that he did not want to advertise again because he did not have a license to do so. When asked his reaction to Imagine's allegation that he was selling pirated games, he replied: 'I can't hear you very well... I must go now. I don't have time. I have many work.'

On the record

Kenneth Baker, Minister of State for Industry and Information Technology, is a man you might expect to have his finger on the pulse of the Information revolution. And you wouldn't be disappointed — here's what he had to say at the opening of a computer show in London:

'For information to be useful it has to be communicated.'

COMMENT THEM COMMENT

QL prospects

By Ian Scales

If you were the manufacturer of what looks to be a huge-scaled desk-top computer with a standard RS232 interface and a modem in the pipeline your thoughts may well turn to the possibility of offering your own database service along the lines of the Prestel-based Micronet.

If you were running a 'QUB' which promised its members a continuing service of software updates, information and first shots at future mail-order products it may begin to make even more sense.

The software updates could be downloaded, a service could be offered to sell commercial software (on a commission basis perhaps), and users could be kept in touch with each other and the company in question. As this computer product is slated primarily as a business desk-top tool, it could undoubtedly be enhanced by a service with mail-box and Telex facilities.

The manufacturer in question is Sinclair Research. Though the company hasn't expressed any plans for such a service, the launch of the QL seems to provide exactly the right recipe.

According to a Sinclair spokesman there are no plans at present though this doesn't rule out future developments in the future. There has already been some contention over the specifications for Sinclair's

serial interface — in its native state it is incapable of simultaneous send/receive operations, a prerequisite if the interface is to be used in conjunction with a modem for accessing Prestel which uses a full-duplex mode. Under this system the receiving machine automatically 'echoes' characters back to the host as an error check.

Sinclair states that the modem it is currently developing for the machine will be capable of handling full-duplex to overcome this problem.

One of the problems with the Prestel standard is the slow send speed. However, if Sinclair decided to launch its own facility it would be well-placed to choose a different standard with better facilities. Prestel's 75 baud send could be described as a paint-watching routine — it is also very expensive in telephone time.

If Sinclair isn't thinking in these terms, somebody else should be. It seems fairly certain that many QLs will be sold over the next couple of years — enough to present a golden opportunity for the next (and widely predicted) big computer development — effective micro communication.

Given Sir Clive's rather eclectic approach to high technology, it seems at least a possibility — keep watching this space.

VIEW FROM AMERICA



American dream gone sour

By Chris Rowley

Silicon Valley, the land of hot tubs and Ferraris for the electronic tribe, right? Right indeed, but something's amiss.

No longer does every young chip designer worth his substrate hanker for the Promised Land. For a start he can't afford a house in the Valley; secondly, the Valley is taking on a darker reputation that is more the stuff of nightmares than the good life.

House prices in sought-after sections like Los Altos Hills and Portola Valley have gone through \$300,000 for the basic Californian ranch house with three acres. This is at least twice what you'd pay in the most expensive suburbs back East. Nobody can afford that unless they're earning \$100,000 or so, and thus companies in the Valley find it hard to recruit: to one former Valley-dweller it looks this way: 'The engineer who had a \$75,000 place by a lake in Minnesota can't buy anything here.'

Meanwhile those already there are producing the sort of statistics to make sadistic psychologists drool. The divorce rate is among the highest in the country. Child abuse, drug abuse and alcoholism have become commonplace. Dads come home from 80 hour weeks working on the next generation of wonder machine in an atmosphere of entrepreneurial excitement and 'it's like coming down off a cloud,' to quote Judith Larsen, who has interviewed hundreds of Valley women. 'They just can't handle the boredom.'

It's killing most of them,' asserts a psychologist familiar with the scene. Everyone is driven to succeed by the news of neighbours who just went public on Wall Street and made millions. They're caught up in the Silicon Gold Rush. Nobody can sleep as a result.

Life-style emulation has \$60,000 a year engineers out on spending sprees on the strength of the millions they know they will make in just a couple of years. Speaking of this phenomenon Dr Regina Kriss, a family therapist in Palo Alto, says: 'They are spending \$500 on a night out — the best wines, perfect children, perfect dress... Meanwhile at home they're fighting like dogs.'

Even worse for many is the cloud of paranoia and suspicion that has settled over the Valley in the wake of sundry spy sensations. Who's bugging who? In some companies employees regularly de-bug their own offices — big companies that grew from small firms founded by defectors from older companies are wary of allowing the same thing to happen to them. They demand loyalty and will enforce it in court. Nobody knows who they can trust. IBM and Intel, among others, have taken vigorous action against insider traitors.

Anyone involved in a breakthrough project these days must move cautiously indeed.

Nor is there much safety outside the office. Spies are everywhere, serving everyone from the KGB to the Japanese computer concerns, and where there are spies there is the FBI. In addition, all manner of hustlers and con-artists float through the Valley social scene seeking their prey. The rule might be expressed thus: the more cocaine in the room, the more likely it is that some of the parties are not who they seem... and that someone is filming the proceedings.

One ID that many Silicon Valley people would love to know is that of 'The Shadow' — the perpetrator of the micro industry's first chain letter which boasts the AIBMUGO (Anti IBM Underground Guerilla Organisation) that exhorts its readers to 'contaminate IBM's database' and claims that 'if the PC Jr is a rifle aimed at Apple's Ite Cash Cow, then networked 68000s are cannons aimed at IBM's mainframe dogs'. To join AIBMUGO write to Fourth Court, Hermosa Beach, California 90254.

But if Silicon Valley people face formidable obstacles in their pursuit of wealth and happiness they are also the first to be offered a computer driven sensory deprivation tank as a life-style aid. Psykon of Palo Alto charges \$20 an hour for a two hour session lying in a brine-filled tank while an Apple II drives a video system floating in the dark above your head, to feed your brain such images as the perfect backhand over and over, in video and slowmo, with compugraphics — until you get it right.

Unix universal

The recognition of Unix as standard operating system for 16-bit and 32-bit computers took a big step forward last week following two separate announcements.

IBM said it will offer Unix, under the name of PC/IX, for the PC in April in the US, and Digital Research released details of an agreement with AT&T under whose umbrella Unix was devised to develop a library of applications software for programmers and end users.

But there are divergencies in approach. In keeping with the PC philosophy of using proven — some would say out-of-date — technology, IBM has opted for an implementation of Unix System III.

Digital Research, meanwhile, will be concentrating its efforts on the latest version, System V, and the one designed by AT&T to be the commercial standard.

The significance of this decision is that AT&T has already signed agreements with the major chip manufacturers to standardise on System V.

Digital Research is already in-

volved in this and is doing the 'port' on to the 286 chip for Intel. Motorola is doing its own port for the 68000 family of processors.

IBM's decision to implement a version of Unix on the PC opens a range of technical and scientific software for PC users as well as giving the Big Blue's seal of approval to the multi-tasking, multi-user operating system.

Interestingly, IBM has not opted for either of the two leading commercial implementations, Xenix from Microsoft and UniPlus from UniSoft. Instead it has gone to Interactive Systems, a small California based software house.

The indications are that IBM is avoiding dependence on one software company. The company is working on other versions of Unix for use on mainframes and other products.

In true IBM fashion it is not revealing any details nor will it discuss what operating system will be used on its present project, the Popcorn, believed to be based on the Intel 80186. Some IBM-watchers say Microsoft is not involved.

Sirius & IBM boards abound

Dataflex will release a Sirius expansion board plus a modem board for the IBM and Sirius in early April.

The expansion board will be kitted out with two serial ports, one parallel port, clock, battery back-up, fitted memory of 128K upgradable to 384K and a price tag of £356.50.

The modem board, for use on the IBM and Sirius, will cost £172.50 and will enable you to dial into US

and European networks as well as those in the UK.

David Low, director of Dataflex, said as long as everything goes according to plan, the board will be CCITT (European Communications Standard) and Bell Telephone compatible.

It will come with communications software, and by April may be accompanied by a Viewdata type package.

BBC Micro through a lens

One of the more unusual BBC micro peripherals has been given greater scope by the addition of two software packages.

Digithurst's (0223 208926) Microsight vision system now includes BBC Hi-Res, which lets you display a 256 by 256 image in mode 0, and a

Photo Graphics package which displays an image of the same resolution in mode 2, representing colour on a monochrome display with grey shades.

The Microsight system — a camera, the software, and documentation — costs £570.



Magic lantern show — Microsight in action.

Acorn locks under attack

Pressure is growing on Acorn either to relax its copyright policy or to change its locks wholesale.

Acornsoft has launched a service that it promised before Christmas to let owners of cassette-based software trade in programs for disk equivalents at half the normal price. But at the same time another magazine has undermined its locking mechanism, demonstrating how simple a matter it is to sidestep the protection of a software lock.

Software houses selling routines with a similar purpose are also continuing to trade, and an Acorn spokesman said: 'Until somebody produces a lock that's uncrackable you'll just have to keep on changing your lock.'

Acorn hasn't given up hope of protecting its software through

legal channels. Having won an out-of-court settlement against the monthly *Personal Computer World* before Christmas (Issue 42) it says that it may now take on Acorn User for an article the magazine ran in its February issue. 'Some action is being considered but I don't know what it is going to be,' said the spokesman.

But in this case it may not need to go to law. Redwood Publishing, a company of which non-executive Acorn director Christopher Ward is a director, is in the process of buying the magazine. The Acorn spokesman acknowledged that links exist between the two companies and admitted that the idea of Acornsoft taking legal action against a Redwood title was an unlikely prospect.

Prestel charges in time warp

If you've just joined Micronet and you've received a Prestel bill you don't understand, there may be a good reason. Prestel may have started billing you before you actually received your modem and were in a position to start incurring charges.

Micronet sends the paperwork to Prestel and its dispatch department at the same time on receipt of your order, so Prestel actually starts billing you for the standing charge without having any confirmation that you've received the modem.

Micronet says that there are very few cases where delays have occur-

red, and that the VTX5000 modem has always been in ample supply.

But at least one reader waited 12 weeks before a faulty VTX5000 was delivered, and he was billed for most of this period.

Micronet claims that this is very unusual, but says that in such cases arrangements have been made to supply a credit against your Prestel account.

So if you've sent off an order for a VTX5000, make a note of the date you receive your Prestel acknowledgement, and if you have to wait longer for your modem, let the company know.

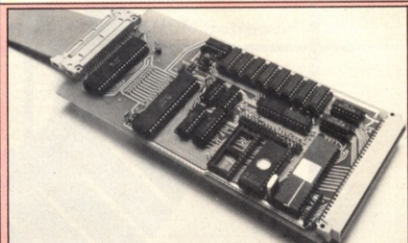
Printer prices plunge as importers crop the daisies

Daisywheel printers are dropping in price faster than the eye can follow. This is mainly thanks to British distributors buying large quantities of Japanese daisywheels and selling them at a very low profit margin.

The latest company to sell printers at cut-throat prices is Daytron which is offering the Smith Corona TP-1 (Pro-Tested in Issue 19) at £259, nearly £300 under the original

price of £553 from Smith Corona. David Roberts, managing director of Daytron, said the company had purchased a large number of TP-1's. Dataplus is also selling them at £250.

Another company to cut costs recently has been Kiaeke, which is selling a daisywheel at £332.50. This printer is the same basic model as the Turbo 20 (Pro-Tested in Issue 45) which cost £459.



FLEXUS — As BBC users still wait in vain for second processors from Acorn, another Cambridge company has stepped in to plug the gap. Cambridge Microprocessor Systems (0223 276791) has introduced a 6809 board that comes with 64K of memory and can be installed under the lid of the BBC. In addition to the board, the company is also offering the Flex disk operating system to allow users access to a wide range of software including languages such as PL9, C, BCPL, Pascal, Fortran, FORTH and COBOL. The board and connecting cable costs £259 plus VAT with Flex at £130.

Kaypro cuts

CK Computers has decided to reduce the price of the Kaypro 10 transportable business computer (Pro-Tested, Issue 35).

According to CK the Kaypro 10,

with its 10Mb hard disk storage, accounts for about half the current Kaypro volume in the US. This has enabled Kaypro to cut its own costs by high volume component orders.

The Kaypro 10 will now cost £2,595 — a £300 drop on the initial price.

SOFTWARE

The new releases

Various: Cases Computer Simulations (01-858 0763) has published a dozen games that mix adventures, strategy games and shoot-em-ups for the ZX81, Spectrum, BBC and Oric 1. For the Spectrum there are *Airline*, *Autochef*, *Brewery*, *British Lowland*, *Corn Cropper*, *Dallas*, *Print Shop*, and *Manage* for £6 each. For the same price are *Gangsters*, *Polaris*, *Plunder*, and *Smuggler*. For £5 there are *Abyss*, *Byte*, *Camelot* and *Solitaire* — many of these are available on the other systems; contact Cases for full details.

Spectrum: Automata (0705 735242) has launched another assault on good taste in the form of Pi-balled, the latest game to feature its egregious little creation Piman. The game can be played with a Kempston joystick and has

a musical single, no less, on the flipside. The price is £6. Phipps Associates (01-393 0283) has released four games for Spectrums, all at £5.95. *Killer Knight*, *House of the Living Dead*, *Loony Zoo* and *Bull Run* are the titles.

Oric: Tansoft has released *Rat-Splat*, which pits a sewerman against cheese-crazed rats. It is £7.95's worth of good clean fun, as you can imagine.

Business

Apple II: A spreadsheet more powerful than Visicalc is the claim made for Ultra Plan from Videx. Designed to be used with Videx's Videoterm 80-column card you can generate screens with up to 128 columns. It can also work with additional memory cards for models as large as 512K and is compatible with

Visicalc files. It costs £139 plus VAT from Pete and Pam.

IBM: Also from Pete & Pam comes *Sideways*, a program that lets you print out all the spreadsheet columns you need with one command. As the name suggests, it gets your printer to turn the spreadsheet through 90 degrees effectively printing the sheet out sideways — great if you want to print a 120 column spreadsheet on an 80-column printer. It works with a number of printers, including Epson and IBM graphics printer, and is compatible with I-2-3, VisiCalc, Multiplan and SuperCalc as well as most word processors. *Sideways* costs £50 plus VAT.

Spectrum: Richard Shepherd Software (06286 63311) is bidding for the title of first professional software for ZX Microdrive

with its *Cash Controller* program. It is a home budgeting program that can handle 400 transactions which can be automatically allocated against 16 selected budget headings. The program costs £9.95 and comes on cassette but includes an option in the main menu to save the program onto a blank Microdrive cartridge when supplies are more readily available.

Utilities

Seiko 8600: A 16-bit version of the multi-user Oasis operating system is now available in the UK from Intelligence (UK) (01-740 5758). In addition to supporting compiled and interpreted Basic, RM Cobol and C, the operating system comes with CP/M86 and MSDOS emulators so that you can run your existing software.

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Tape copying locked

By David Guest

An American happily exiled in Barnsley may have solved a problem that has defeated all-comers for years — how to protect tape-based software.

Jim Lamont, head of a tape duplication business in Barnsley, has applied for a patent on the idea that he refers to as Copylock. Ironically, he may have to change the name since Export Software International already uses it on a disk system (Issue 38). But Mr

Lamont's Copylock applies only to tapes and he claims that it is foolproof.

"You can't make a copy from one cassette recorder to another," he says. "It can't be copied by a machine code copier, nor could it ever be."

Exactly how the idea works is a subject that Mr Lamont is not about to explain too precisely. "It's a coded imprint, invisible in use, on the master tape. It only appears when somebody tries to copy it," he

says. "We put it on to the master tape as the program itself goes on. That involves some specialised equipment, but you can buy that for about £200."

JLC, the company that has developed Copylock, intends to licence it such that the price of applying it to tapes should not work out at higher than 1p or 2p per copy. Mr Lamont commented: "Every tape that's pirated hurts us as well as the software houses, and hence the customers — this idea won't in-

crease costs one little bit."

"Copylock is something we've been trying to do for about two years, and we've been putting it together piece by piece," he said. "It includes a very short program mingled into the main one and some electronics to put the imprint on to the tape — we've had to look at it from the duplicator's point of view."

PCN hopes to test Mr Lamont's claims for Copylock in a forthcoming issue. Anybody interested should contact JLC on 0226 87707.

Headstart trio

Three new business micros are due from Intertec in April.

Known as the Headstart range, they are the VPU 128, 512 or 1000. The 512, for £3,329, has 512K RAM expandable to 1 Mb and uses a single disk drive with a 500K 3½in microdisk. Like the rest of the family, it has a dual processor — a

Z80A and an 8086 — with the former running at 4 Mhz and the latter at 8.

It runs CP/M80 and MSDOS, has 18 function keys, a numeric pad and RS232 and Centronics type printer ports. The range will be distributed by Professional Microcomputers in Longstanton, Cambridge.

System builder swings Pick

An applications generator for the IBM PC has been launched to run under the Pick operating system, reputed to be the easiest development environment available.

The package is called System Builder and it runs under Revelation, Cosmos' implementation of Pick. This combination should make the PC as accessible to inexperienced users as it could

possibly be, if System Builder lives up to the claims made for it.

It will be supplied on floppy or hard disk by Aston Technology's dealer network, and the price is £632. Revelation on the PC costs £977.50.

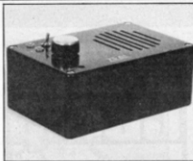
System Builder has an enquiry language that permits you to use its database with English-like commands.

PERIPHERALS

The new releases

Disk Drives: A new 3in microfloppy drive has been launched for the BBC micro. The Micro Pulse from Northern Computers (0928-35110) combines compact size with a compact price. For £169.90 (plus VAT) you get a drive, double sided 100K utility disk, cable and user manual. Included in the software is a utility that allows you to transcribe software from cassette or 5¼in disk on to a microfloppy. At the other end of the scale Newbury Data (0784-61500) has signed a deal with Maxtor Corp to manufacture and market 5¼in Winchester drives with capacities of 65Mb, 105Mb and 140Mb.

Printers: Brother seems out to prove it can make the cheapest printer available. The HR-5 costs just £147 (plus VAT) and can operate on battery or mains power. Printing speeds of 30 cps are



Zeal gives the Spectrum something to sound off about.

possible with 10 or 12 characters an inch using a 9 by 9 dot matrix. It weighs only 3½lbs and comes with a choice of RS232 or Centronics parallel interfaces. The cost of plotters also seems to be coming down. Pete & Pam Computers says that it hopes to take deliveries at the end of February of the Sweet-P Model 600 Six Shooter graphics plotter and to sell them at £850 (plus



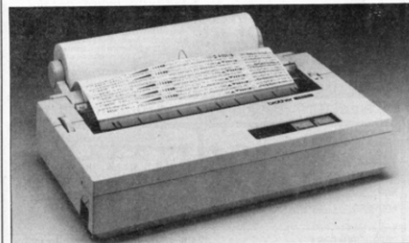
Micro Pulse 3in drives — small is beautiful.

VAT) each. The plotter has a rotating carousel holding six colour pens (from a choice of 12), 2K buffer and a plotting speed of 14 inches a second. A novel feature is that the plotter automatically senses if a parallel or serial interface is connected and switches to the port in use. The Six Shooter comes with the Sweet-P graphics language and can be used with Apple, IBM and CP/M micros.

Joysticks: Emax Computing (0262-602541) has cut the price of its Arcade Professional Joystick to £28.95 and is offering a New Year bonus to existing users — a refund on the price difference. In

addition the company is offering interfaces to use the joystick with the BBC B and the Dragon. AGF Hardware (0243 823337) is to cut the price of its programmable joystick interface by £6 from March 1, bringing it down to £26.95. The second player socket has been sacrificed but a design improvement allows the use of the Quickshot II joystick's rapid fire feature.

Sound Box: Fed up with the sound from your Spectrum? Zeal Marketing (0246-208555) can help with a sound 'booster' costing £14.99. It plugs into the Spectrum and gives you a 3in speaker with volume control.



Brother HR-5 — the family grows larger ...



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PCN

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TW	LW	MANUFACTURER	PRICE	DISTRIBUTOR
▶1	(1)	Spectrum	£99	(SI)
▶2	(2)	CBM 64	£220	(CO)
▲3	(4)	Sinclair ZX81	£45	(SI)
▼4	(3)	BBC B	£399	(AC)
▶5	(5)	Vic 20	£140	(CO)
▲6	(8)	Atari 600XL	£160	(AT)
▼7	(6)	Oric 1	£99	(OR)
▲8	(9)	Lynx 48/96	£225	(CA)
▼9	(7)	Dragon 32	£170	(DD)
▲10	(12)	TI 994A	£90	(TI)
▼11	(10)	Sharp MZ700	£240	(SH)
▲12	(13)	Atari 800	£300	(AT)
▼13	(11)	Apple IIe	£750	(AP)
▲14	(15)	Sharp MZ80A	£349	(SH)
▲15	(16)	Aquarius	£70	(MA)
▼16	(14)	Colour Genie	£168	(LO)
▲17	(18)	Epson HX20	£472	(EP)
▲18	(—)	Electron	£199	(AC)
▶19	(19)	CGLM5	£150	(SO)
▼20	(17)	Tandy Colour	£180	(TA)

These charts are compiled from both independent and multiple sources across the nation. They reflect what's happening in high streets in the two weeks up to January 14th.

Neither mail order nor deposit-only orders are included in these listings. The prices quoted are for the no-frills models and include V.A.T. Information for the top-selling micros is culled from retailers and dealers throughout the country and, like the games, is updated every alternate week.

PCN Charts are compiled exclusively for us by MRIB (Computers), London (01) 408 0250.

Top Ten over £1,000

TW	LW	MANUFACTURER	PRICE	DISTRIBUTOR
1	(2)	IBM PC	£2,390	(IBM)
2	(1)	ACT Sirius	£2,525	(ACT)
3	(6)	Apricot	£1,719	(ACT)
4	(4)	Commodore 8000 series	£1,200	(CO)
5	(4)	Apple III	£2,780	(AP)
6	(7)	Kaypro	£1,949	(CKC)
7	(10)	Televideo TS-800 series	£1,495	(MD)
8	(5)	HP86A	£1,570	(HP)
9	(9)	DEC Rainbow	£2,714	(DEC)
10	(8)	Epson QX10	£1,995	(EP)

Distributors: AC Acorn ACT ACT/Sirius AP Apple AT Atari BW Brainwave CA Computers CKC CKC Computers CO Commodore DD Dragon Data DEC Digital Equipment EP Epson HP Hewlett-Packard IBM IBM LO Lowe Electronics MA Mattel MD Midlondon OR Oric SH Sharp SI Sinclair SO Sord TA Tandy TI Texas Instruments
Machines: SP Sinclair Spectrum AC Acorn BBC 64 Commodore 64 V20 Commodore Vic 20 81 Sinclair ZX81 DR Dragon OR Oric AT Atari

Games Top Thirty

	GAME TITLE	PUBLISHER	MACHINE COMPATIBLE								PRICE		
			SP	AC	64	V20	81	DR	OR	AT		OTHERS	
▶1	(1)	Atic Atac	Ultimate	*									£5.50
▶2	(2)	Lunar Jetman	Ultimate	*									£5.50
▲3	(5)	Pyramid	Fantasy	*									£5.50
▲4	(6)	Ant Attack	Quicksilva	*									£6.95
▲5	(17)	Snooker	Visions	*	*	*	*						£8.95
▼6	(3)	Valhalla	Legend	*									£14.95
▲7	(12)	Kong	Ocean	*									£5.90
▼8	(4)	Chequered Flag	Psion	*									£6.95
▼9	(7)	Splat!	Incentive	*									£5.50
▶10	(10)	The Hobbit	Melbourne	*	*	*			*				£14.95
▲11	(21)	Manic Miner	Bugbyte	*									£5.95
▲12	(30)	Death Chase	Micromega	*									£6.95
▲13	(14)	Mr Wimpy	Ocean	*									£6.90
▲14	(—)	The Alchemist	Imagine	*									£5.50
▲15	(—)	Hunchback	Ocean	*	*				*				£6.90
▲16	(8)	Flight Simulation	Psion	*									£7.95
▲17	(—)	Pool	CDS	*									£6.95
▼18	(13)	Arcadia	Imagine	*	*	*							£5.50
▲19	(24)	Penetrator	Melbourne	*									£6.95
▼20	(11)	Hunter Killer	Protek	*									£7.05
▲21	(—)	Jet Pak	Ultimate	*		*							£5.50
▼22	(15)	Falcon Patrol	Virgin		*								£7.00
▼23	(9)	Metagalactic Llamas	Llamosoft			*							£6.00
▲24	(—)	3D Time Trek	Anirog		*	*							£7.00
▼25	(18)	Moonbuggy	Anirog		*								£7.00
▲26	(—)	Crazy Kong	Interceptor		*	*							£7.00
▼27	(16)	Horace And The Spiders	Psion/Melbourne	*									£6.95
▲28	(—)	International Football	Commodore		*								£9.99
▼29	(19)	Hovver Bovver	Llamosoft		*								£7.50
▲30	(—)	China Miner	Interceptor		*								£7.00

Criticism noted, but no cure for piracy

Congratulations to L Hipkin (Issue 43) for highlighting the dishonesty of accepting payment for one piece of software, over and over again. But, did the editor really write:

Problem is, while it may be impossible to eradicate, software piracy is a contributor to the cost of packages. So the consumer pays anyway?

If so, all I can say is eggs hatch from chickens.

Which came first? The software with associated high price, or the pirate? Surely, the initial high price of software contributed to the profit factor available from piracy.

The obvious solution is to reduce the cost of the original software, eg by paying the programmer once only.

The only problem is, are you going to tell Atari or shall I?

*Jeff Best,
Brighton, Sussex.*

Yep — the quote's correct . . . and no apologies. Now I'm interested in how you'd eradicate piracy if software houses agreed to lower prices? — Ed.

And the other side gets a few words in

L Hipkin's letter (Issue 43) challenges us to defend software copyright. This can be done on two distinct, but complementary, counts.

First, L Hipkin is incorrect: royalties payable under copyright don't mean the copyright holder is being paid over and over again for one piece of work; they simply mean all buyers of that work pay a share of the financial reward for the work. If the retail price of a program cassette were to pay for the whole work of writing the program, almost no-one would be able to afford it. This, certainly, means some people will earn far more from the programs they write than do others, but to suggest that these are 'lucky people' protected by an 'artificial barrier' is false.

Copyright law is, it is true, an artificial barrier, but good programs are not written by luck; they are the result of judicious application of skills. Mr Hipkin clearly believes in the virtues of fairness and honesty, and there are people who would argue that it is fair to pay more for a job well done.

RANDOM



ACCESS

Don't carry a LOAD on your shoulders, unburden yourself on PCN's letters page.

And what is a 'good' program? Well, one answer is a program that pleases enough people to sell a lot of copies. Fairness also seems to indicate we have a right to the fruits of our labours. In this respect there is no intrinsic difference between writing programs for micros and growing apples for market.

Now consider other effects of protection, or lack of it. If an author is reasonably confident of a fair return for effort expended, then time and energy can be put into improving the quality of the program — which means fewer, but better, programs.

If the author knows whatever they do will soon be copied (and the rip-off time for a good program will be at least

consumer who pays for software piracy. But in two ways: not only in higher prices, but also in the lower quality of the product. At this point I should declare my interest: I am a consumer, not an originator or publisher of software.

*Martin Smith,
Headington, Oxford.*

Calling all micro owners

I need volunteers to assist me with a survey I am carrying out at the moment about people and their computers; the survey will eventually result in an article, hopefully to be published early next year.

If you would like a questionnaire please write to: Miss Carhart, 40 Newark Park Way, Royton, Oldham OL2 5YQ. (Including SAE.)

Oric's next language

With the success of 'Oric en France' I expect to find the new ROM containing gems such as:

ECRIRE X, Y FB (draw)
FINI to DRAW TO
end (or vice versa)

POURN = 1A* PIED 2 (FOR N = 1 TO X STEP 2)

but VOULEX vous could never replace GET

SI A = 10 ALORS TIRER
"Franglains roules"

ON N GOSUB would become
AU N VASOUS

but ON N GOTO is difficult as AU
N VA A

SHOOT should be TIRER but
this word is getting overused as it ought to be PULL.

*P Holland,
Wembley, Middlesex.*

Computerese not spoken here

There has been much correspondence recently both from and about computer store staff and customers. I am fairly impartial but I think I speak for many regarding the computer twits as a menace.

This animal is found at all levels of computing. They are easily recognised by a complacent smirk on their faces and the inability to string words together in a meaningful manner. They do not meet each other, they interface and their brains are in fact filled with incorrectly programmed EPROMs.

To ordinary people, one word of advice. Challenge them. As soon as they lapse into gobbledygook, tell them to explain it. There is no term used below research level which cannot be put in simple words, often more correctly, and it is a mark of an idiot not to know when speech has ceased to be communication.

Do not worry about hurting the feelings of the twits, because they have tried to belittle you, so make them speak plain English. Particularly if you are a customer, remember they are paid by you. If you are an assistant in a store, do not worry about the twit, he buys mail order and is only in your shop to further inflate his personal vanity.

I am not suggesting you are rude, though I have on occasions been very forthright with half-baked sales people, but do not be put down by them. *David Walton FCMA,
Riyadh, Saudi Arabia.*

But some computerese is acceptable if spoken between those in the know and used where a non-jargon explanation would be unacceptably verbose. Of course, to talk microspak to the uninitiated is really rather rude and is certainly unnecessary (unless you want to belittle) — Ed.

Share your thoughts in the UK's liveliest micro weekly letters columns. Funny, feisty or fanciful, your letter could win you £10 if it's of star status. **WRITE TO:** Random Access, Personal Computer News, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

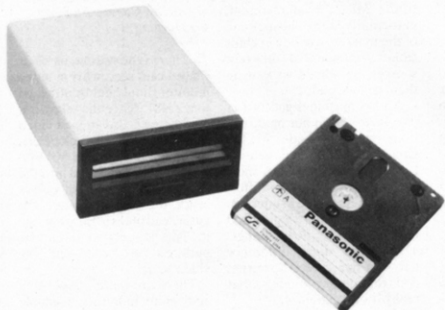
PCN £10 Star Letter



as short as for a bad one, while the loss from a good program will be greater, as more people will copy it), then the tendency will be to rehash known successes, thereby hitting the market the maximum number of times for the minimum of effort. As a result we get adaptation rather than innovation. To some extent this already happens because of the difficulty of copyright protection in this area.

To sum up, fairness demands the author be rewarded suitably for the job done and, as the editorial comment adds, it's the

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Write to: Routine Inquiries, *Personal Computer News*, VNU, Evelyn House, 62 Oxford Street, London W1A 2HG.

Keeping Oric adventure secrets

Q A friend and I are trying to write an adventure game for the Oric. Can you tell us how to lock up a listing, or, preferably, how to prevent people from breaking into the program. We do not want to seize up the computer or cold-boot it if someone presses BREAK or CTRL-C.

Matthew Platts, Malmesbury, Wiltshire.

A There's no simple way to do what you want. Bob Maunier, in his book *The Oric Handbook*, gives some useful POKES for making a program NEW itself or hang up the Oric when it's interrupted in a program. But, we have not been able to modify this information to make the Oric simply ignore BREAK or CTRL-C.

Resolve this Spectrum mystery

Q According to the manual my issue 2 Spectrum has high-resolution graphics of 256 x 176, but according to other computer magazines it should have 256 x 192. Could you please explain this.

Recently I read a magazine which gave a detailed review of the Spectrum's insides. I then opened up my Spectrum and found that all the chips had different names from the ones in the magazine. Also the wiring of the Z80 chip is totally different. I wonder if this had anything to do with the graphics problem.

J Hendersen, Newmarket, Suffolk.

A First of all, you don't have a graphics problem. When you're building a user defined graphic, you do so on an 8 x 8 grid, right? Now, if you multiply the Spectrum's 32 columns and 22 rows, you get a graphics screen of 256 x 176. It's a bit naughty to talk about a screen depth of 192, as this takes you into the report line section (2 x 8 = 16, and 176 + 16 = 192) but

it's not quite wrong.

As far as the insides of the machine are concerned, you'll find a considerable variation between machines, and this doesn't just apply to the Spectrum. Micro manufacturers, particularly at the cheaper end of the market, will buy in chips from a number of different sources, so what's written on them will vary a lot.

And as machines get further into their life, minor modifications will be made to the circuitry and to the general layout of the board. In most cases this will make no difference to the machine in question — it's simply a more logical and efficient way of doing things. There is a slight difference between the issue 3 Spectrum and the earlier models, but really it's negligible.

Elan Enterprise crystal ball

Q I have three questions about the Elan Enterprise. They are: how much memory will it have; will it use mostly cassettes; how much will it cost?

Kevin Rhyned, Aberdeen.

A Only three? 'Will it ever exist?' might be a more salient question.

However, according to some recent information it would appear that the Enterprise will come with 64K RAM as standard, upgradable from 128K to 3968K.

It will run cassette-based software and will have a port for cartridges as well as an expansion pack to use a microdrive.

Whether software will mainly be on cassette depends on the software houses who adopt it.

All this could cost a mere £200, according to the advertising.

ZX81 video niceties

Q I am writing to ask if it's possible to connect my ZX81 to a monitor and what peripherals would be needed. At the moment, I use a portable B&W television. Could you also tell me what type of monitor to buy and how much would it cost.

Lastly could you tell me if it is possible to connect my computer to a disk drive. This would be a great advantage since we all know how slow and unreliable cassette storage is on the ZX81.

G Shields, Chester Le Street Co Durham

A There is no reason, as far as we can see, why a video monitor should not be attached to a ZX81. Since the television modulator is driven by a video signal (normally one volt peak), the only problem is to find where this signal is fed into the modulator (the large silver box inside the machine where the aerial lead plugs in) and tap into it. The connection should be between zero volts and the video signal.

There are quite a few black and white monitors available and these are rather 'much of a muckness' so the best thing is to buy the cheapest at around £95. Buying a high quality monitor will not make a great deal of difference from buying a cheaper one since the ZX81 does not use high-resolution graphics. If you can, try your modified machine with a monitor before you splash out, just to make sure it works.

The only disk drive that seems to be available for the ZX81 is FIZOF made by Macronics, 26 Spiers Close, Solihull, Birmingham. It costs £90.85 and has 48K on the 40 track drive.

Interfacing Star's dot matrix printer

Q I own a Star DP-510 dot matrix printer which I use with a 48K Spectrum and a centronics parallel interface, and I would appreciate any information on converting the printer to take an RS-232 interface.

Serial interface connectors were an optional choice on this machine so is it possible to adapt it?

This change would enable me to use the printer with the ZX Interface 1.

I would particularly like to know where I could obtain the following:

● Instructions for converting the printer and possibly keeping the connections of the parallel connectors.

● The necessary parts to carry out conversions.

● Any instructions necessary to test the modifications done.

J. Gaffney, Scotland.

A The best advice is to go back to the dealer. According to Star distributor, Micropipherals, the serial interfaces are in stock. The price is £59 plus VAT. According to the company the installation procedure is simply a matter of taking off the printer's cover and plugging the interface in.

If you really want to, it should be possible to convince the dealer to install the item and set the DIP switches, though all you need is a little common sense.

If, by chance, you didn't acquire the printer through a local dealer you can find the nearest by calling Micropipherals on (0256) 3232.

ZX81 joysticks need interfaces

Q Could you advise me on buying a joystick for my ZX81? I need to know where to get them, which is the best and how much it costs.

P Doley, Arbutothorne, Sheffield.

A The most common type of joystick for use with micros is Atari. To use one of these you will need an interface to go between the computer and the joystick. There are a number of these available and if you cannot buy one locally you could try mail order.

All the micro magazines carry adverts for joystick interfaces: a common one is the KEMP from Kempston Microelectronics, 180a Bedford Road, Kempston, Bedford.

It costs £15 and most software houses produce games adapted for its use, so it has become something of a standard.

Kempston also sells the 'Competition Pro' Joystick (£14.50) which is of the standard Atari type.

If you can find a high street shop that sells standard joysticks you should try out as many as you can get your hands on, till you find one that suits you.

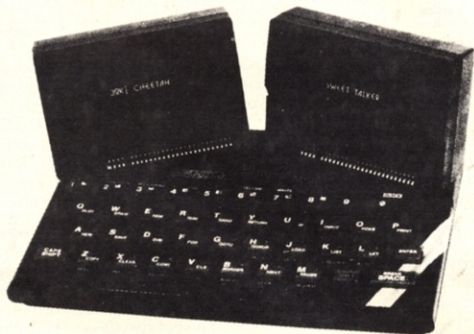
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Oric code considered

If you are trying to develop machine code programs on the Oric-1 there is a good possibility that you are having problems. The following points may be of help in saving Oric users a lot of trouble.

The instruction `POKE 15342 #60` will not work because the number is specified in hexadecimal format. The computer does not respond with an error message but also does not perform the operation. The rule is, always specify the value to be `POKE`d in decimal. Also watch out for the keyword `DEF` popping up in hexadecimal numbers because the computer will report an error message and again will not perform the operation. Such an instruction might be:

```
LET A=#9 DEF
POKE #DEF,9
```

Then can easily be amended so as not to produce an error message in two ways.

```
LET A=#9DEF (Place a space in
the middle of the number)
```

```
or
LET A=#9 DEF+1
```

*N Jones,
Acklam,
Middlesbrough,
Cleveland*

Microsoft Basic random numbers

Nearly every Microsoft Basic program that owners write utilises a random number generator. Often it is used in different parts of the program. In Microsoft Basic, it uses generally takes the form:

```
X=INT(100*RND(1)+1) where
100 is the range.
```

This is rather cumbersome and can be improved by defining the expression as a function:

```
10DEF FNR (X)=INT (X*RND
(1))+1
```

To obtain random numbers, simply use `R=FNR(100)`. Throwing two dice can be reduced to `D=FNR(6)+FNR(6)`. The method is not only shorter, but faster as well.

*Paul Roper,
Gosport, Hants.*

Oric HIRES education

I have discovered my letter in issue 36 about Oric HIRES routines, has an error. `POINT` is placed at `#EB1F`, whereas it is actually located at `#EBF1`. I have also found the routines for four more Basic instructions:

```
HIRES #E9BB
TEXT #E9A9
KEYS #E905
GET #C5FB
```

The accumulator holds the contents of the Key buffer in the case of `KEY$` and `GET`.

`GET`, in fact, polls `KEY$` until a key is pressed. On return from `KEY$`, the `N` flag is set if a key is pressed.

Some Oric programmers, whether machine code or Basic, may find using the `KEY$` instruction before an `INPUT` or `GET` to clear the buffer, useful. After a video game, for instance, so that, for example, the letter `F` doesn't appear after an 'Enter your name' prompt on new high score.

One unpublished fact about the 16K Oric-1 that I recently discovered, is that the `RAM` repeats `ZX81` style. This means that `POKE 48000,65` will place the letter `A` into the top left hand corner of the screen, irrespective of whether you are using a 16 or 48K machine. So any 48K game which can fit into the 16K machine can be ported across with no screen `POKE` modifications.

*Andrew McDermott,
Nr Farringdon, Oxon.*

When using the addresses for the Basic routines given above, it is usually necessary to place the data to be used into a parameter table.

With regard to `POKE`ing the screen, if you `POKE` both locations (high and low) your basic program may be corrupted (nobody here seems to know why and all suggestions will be gratefully received.) If, however, you only use one (high or low) there seems to be no problem. *KG*

Spectrum scroller-coaster

While `POKE`ing around inside my Spectrum, I found a location that enables a line to be scrolled over and over again on the same line:

```
10FOR A=0 TO 255
20POKE 23606,A
30PRINT AT 10,0;"ABCDEFHGHIK
LMNOPQRSTUVWXYZ"
40NEXT A
50GOTO 10
Prithesh Parmar,  
Leicester.
```

Speed up your Atari's Basic

To speed up (most) Basic programs and save memory on the Atari, check whether the following forms of the `IF THEN` statement are in use.

```
1 IF A<>0 THEN statement
2 IF A=0 THEN statement
Replace these with:
1 IF A THEN statement
2 IF NOT A THEN statement
```

In Atari Basic the average time saved by the second methods are 25 per cent and 14 per cent respectively.

Atari Basic can be made to go faster (about 3 per cent) by using `POKE 66,1`. Note this has the effect of partially disabling the keyboard so `POKE 66,0` after the fast section to return to normal.

*Nick Pearce,
St Leonards-on-Sea, E Sussex.*

When data must be updated constantly

The following may help readers who save data on tape. It is especially useful when data must be constantly updated.

Use one tape for each set of data. This is used to hold two versions of the data; the most recent copy and the second most recent copy. One set of data is recorded on each side of the tape, to ensure a recent version of the data is available despite accidents.

Each time the tape is used, load the most recent data and save over the second most recent version. When data is saved, rewind the tape to the beginning of the newest data. This saves time when loading and shows which is the most recent side.

*RJ Walton,
Littlemore, Oxford.*

Extra space in Spectrum memory

I was writing a 16K program for my Spectrum and just as I tried to enter some machine code, I found I was out of memory space. After some puzzling, I `POKE`d the code into the printer buffer (locations 23296 to 23552). This gives an extra 256 bytes of memory.

*G Patterson,
Hunville, Australia.*

Commodore 64 jiffies in the bag

Recently a reader explained how Commodore 64 owners could obtain the time in Jiffies (1/60 of a second).

However, no reference was made to the fact that the jiffy clock can be `PEEK`d. It is at locations 160, 161 and 162. This means the time can be altered by `POKE`ing these locations and read by `PEEK`ing them. The `WAIT` instruction can be used in conjunction with these locations to time delays. eg
`TIS="000000";WAIT 162,128`
will wait for 128 jiffies (approx 2 seconds)

`TIS="000000";WAIT 161,2`
will wait for 256.2 JIFFIES (APPROX EIGHT SECONDS).

The clock can be switched off at any time with:

```
POKE 788,PEEK(788)+3
```

```
POKE 788,PEEK(788)-3
```

(Disabling the clock disables the `RUN/STOP` key).

*David Gristwood,
Sunderland, Tyne & Wear.*

Beeb speed

To run the Beeb's RS423 interface at 600 baud requires a simple trick.

Set up the baud rate at 150 baud and then alter the clock division in the 6850 chip with:

```
*FX156,1,253
```

*David Williams,
Birmingham*

Spectrum stopped

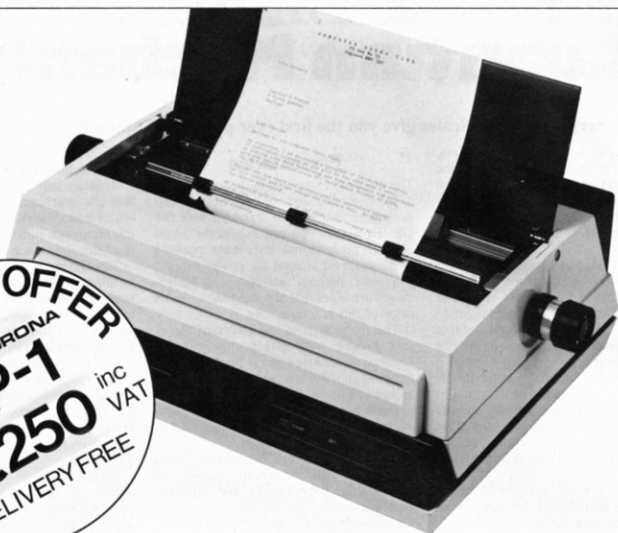
On the Spectrum, you can `STOP` a program while it is waiting for a string input ie:

```
10INPUT "I WANT TO STOP THIS PROGRAM";A$
```

Move the cursor to the left outside of the string quotes and then enter `STOP`.

*G M Charnick,
Hornchurch, Essex*

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R. Brothwood

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Quantum Mechanics

Geoff Wheelwright and Ian Scales give you the first ever preview of Sinclair's innovative new micro.

Once a year, for the past four years, Sir Clive Sinclair has stunned the computer world by introducing a computer product that breaks new ground in both price and technology. With his new QL micro, he has done it again.

It seems that Sir Clive and Sinclair Research have an uncanny ability to judge the current mindset of computer purchasers and apply that judgement to making lots of computers and lots of money. When people had little or no idea of what a home computer was or what it could do, he supplied them with the 1K ZX-80 and ZX-81 machines for under £100. When those same people saw the power and desirability of more memory and colour in a home computer, he brought out the Spectrum in 16 and 48K versions.

Now Sir Clive — along with many other astute British and Japanese companies — has seen the growing demand for business-type computers in the £400 to £1000 range. Sinclair's competitors have responded by building cheap versions of standard CP/M systems or the IBM PC.

Sir Clive's approach to the market, as always, is both unconventional and brilliant. With the new £399 QL micro he has literally leap-frogged beyond CP/M, MS-DOS and IBM-compatibility, and accomplished the Quantum Leap that is claimed in the name of this new machine.

Not only has he jumped from a 8-bit processor to a 32-bit, but he has also incorporated a new operating system (Q-DOS) and an impressive multi-tasking capability in a machine that has two to three times the RAM of any of its nearest price competitors.

Presentation

The machine examined in this review was a pilot model and didn't include the packaging that will be standard with the QL. However, you can expect the usual Sinclair professional styrofoam packing to be wrapped around the power supply, computer, manual, software and Microdrive cartridges that are included with the price of this machine.

The manual itself is a standard three-ring binder with pages that can be inserted or removed easily for updates to the built-in software and additions to the technical information.

Psion has written four software packages for Sinclair that are all included in the £399 price of the QL:

QL Quill — a full 80-column word processor with on-screen display of underlining, page breaks and different typefaces.

QL Abacus — a VisiCalc-style spreadsheet with the ability to do 'what if?' financial modelling.

QL Archive — a database package that uses its own display language to create your own filing system.

QL Easel — a business graphics program that will do lines, shaded curves, histograms, stacked bar charts or pie charts. It can also access information collected in QL Abacus as each of the programs can 'import' information from the others.

These programs come supplied on Microdrive in their own plastic wallet — this

opens like a book with a hole for each of the cartridges containing the programs.

Because two Microdrives come built into the machine, Sinclair also supplies four blank Microdrive cartridges — the minimum you'll need to get started using the QL.


The QL itself is long, light and narrow — although it is probably shorter than the keyboard of an IBM PC and not even as tall as a Commodore 64. Sinclair has always been good at making its products as small as they can be.

The company should have no problem in shipping the machines by mail-order (and that will be the only way you can buy them until production ramps up and Sinclair gets some machines into the shops late this summer).

Documentation

Gone are the book-type user-guides of the ZX81 and Spectrum. The QL documentation is firmly 'business' like, with a large-format ring-binder and protruding chapter break tabs.

This format makes sense — although not particularly easy to leaf through quickly it indicates Sinclair's commitment to software updates and modifications as the chapters are individually numbered.



Our documentation was provisional only. The all-important Beginner's Guide section had yet to be completed and included. The bulk of the information, of course, is devoted to the four application packages. There is also a considerable section on the SuperBasic Keywords that will be an obvious target for expansion and elaboration as a number of important words and concepts — notably the use of sound, definitions and procedures — are given quite short shrift.

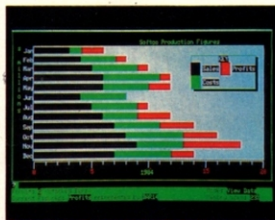
Construction

Pilot and prototype models of computers are not known for their hardness and strength, but if the QL's prototype is anything to go by it should considerably reduce Sinclair's sometimes high return rate on machines. Not only does the QL seem sturdy and well-built, but it has

The RAM pack price has yet to be announced. At present memory chip prices, however, 500K of RAM is unlikely to be much of a bargain. This slot can also be used to house ROM cartridges, though software company Psion is unsure what form these will take and whether their price will make them attractive to most users.



Esasel histogram display — the formats are easily set up.



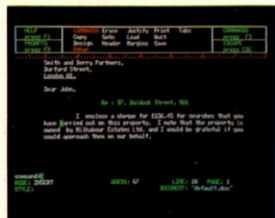
Or you can lay the graphics on their side.



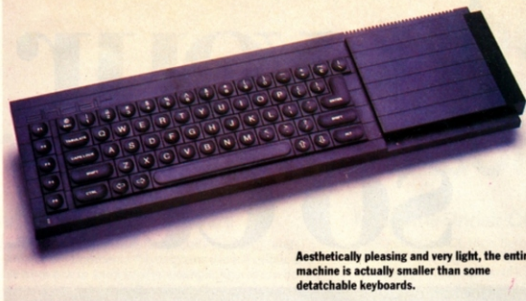
QL Archive language allows you to design your own formats.



QL Abacus uses the traditional spreadsheet layout.



QL Quill seems to owe much to Wordstar but is friendlier



Aesthetically pleasing and very light, the entire machine is actually smaller than some detachable keyboards.

several hardware design features that should keep it from getting damaged.

Firstly, the QL has abandoned the perennial Sinclair bare-board expansion bus in favour of a set of nice, clean recessed plugs at the back of the machine, a neat plug-in for Microdrive extensions of the right-hand side and a proper cartridge plug-in port for ROM and RAM board expansion on the left-hand side.

Secondly, the QL doesn't come with any games software — and even if lots is quickly written for it, those games will likely make use of the joysticks which can be plugged into the QL — rather than forcing certain keys to undergo torture as 'fire' buttons in Space Invader games. Although it has a full-travel typewriter keyboard, there is also a membrane underneath it that protects the guts of the machine from invading particles.

In fact, Sinclair makes the rather fantastic claim that the QL can absorb caffeine without too many adverse effects. 'A membrane beneath the keyboard protects the machine from dust (and coffee!),' claims the QL advertising brochure. Needless to say, we didn't test this feature of the machine.

And thirdly, although Sinclair has not yet brought itself to spend the few extra pennies necessary to include an on/off switch in its latest machine, it has opted for a proper recessed reset button on the right-hand side.

In addition to this, a reset can also be effected from the keyboard by pressing the CTRL, ALT and space bar keys in unison. The keys are sufficiently far apart so that you're not likely to press them all

at once by accident.

Keyboard

The QL keyboard is "ergonomically-designed" and reminiscent of the NCR Decisionmate. In many ways it's just a standard QWERTY job, but it has a few nice touches that should put it a notch above most of the others in its price range.

The SHIFT keys are where you would expect them to be — none of this IBM confusion with a backlash honing in where your SHIFT should be. Sinclair has also taken care to differentiate between CAPS LOCK and SHIFT, so that if you're doing some upper-case programming in SuperBasic your 4's don't get turned into 5 signs by the CAPS LOCK shifting the keys — the CAPS LOCK gives you only upper-case characters on alphabetic keys.

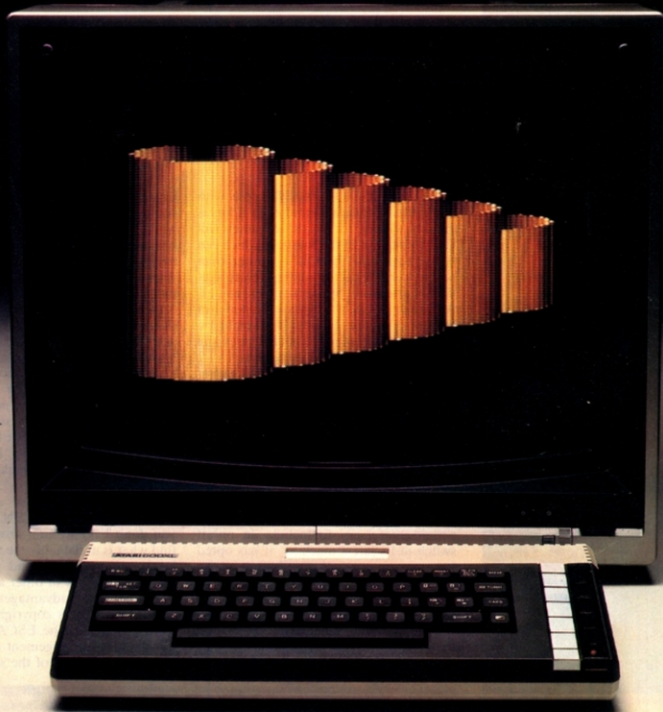
The function keys are nicely separated from the main QWERTY keyboard so you don't hit them by mistake when you're quickly keying in some numbers on the top row of keys. The keys also give off the 'positive audio feedback' or click-click sound that makes life much easier for touch typists.

Finally, the QL has a lovely big 'backwards L-shaped' ENTER key so you don't have to hunt around trying to find what is undeniably the most oft-used key in programming and probably the most popular key in other applications.

Among the disadvantages is the rather odd inclusion of a copyright sign as the shifted value for the ESCAPE key, the non-standard arrangement of the cursor keys on either side of the space bar and



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BASIC programming language plus 8 other languages. HELP key will provide additional information and menu screens. Syntax checking on entry.

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Software: Over 1000 items of software available including self teaching programs with unique voice over. Education. Home management. Programming aids. Atari user written programs (APX). And Atari's famous entertainment software.

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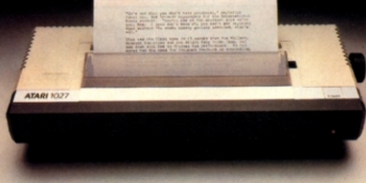
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8. ATARI 1025™ 80 Column Dot Matrix Printer prints 5, 10 or 16.5 characters per inch. 40 characters per second. Ideal for program listings, financial reports, etc.

9. ATARI 1027™ Letter Quality Printer for word processing letters in professional type.

If you'd like to know more about the ATARI 600XL, write to Atari International (UK) Inc., P.O. Box 407, Blackhorse Road, London SE8 5JH and we'll send you all the details.

The new Atari XL home computer system.

ATARI

©ATARI and design. Reg. U.S. Pat and TM Off. TM: Trademark of Atari Inc. The ATARI 600XL is compatible with ATARI 400 and 800 programs.

19 the non-standard ASCII value assigned to the £ sign by having it as a separate unshifted value on the top right-hand side of the keyboard.

But these are quibbles. It may actually turn out to be easier to move a cursor around with the left-right arrows on one side of the space bar and up-and-down on the other. In fact, many games for micros already work that way with the Z and X keys taking the roles of left-right keys and the ' and ? keys acting as up and down.

The inclusion of 'legs' to adjust the tilt of the keyboard should also make it slightly easier to use than many standard keyboards, which cause you to strain your wrists trying to maintain the right attitude over the keyboard.

Storage

Storage on the QL is provided by a brace of Sinclair Microdrives. These devices were first introduced in mid-1982 as an add-on for the Spectrum. The Microdrive uses a very thin 200-inch length of magnetic tape on an endless loop. The tape resides on a single spool and is fed past a magnetic head at 30 inches per second, winding off the inside of the spool and being wound back on the outside of it again. Once it has completed the full length of the tape, in 7.5 seconds, it's back to the start and ready to go again.

The cartridges are tiny but cost a rather hefty £4.95 each. The drives are situated unobtrusively to the right of the keyboard and the cartridges are inserted just under the computer's skin. Further Microdrives can be chained 'à la Spectrum' from an expansion bus. The Spectrum Microdrives are not compatible with the QL.

The QL Microdrives have been upgraded from their original Spectrum versions. The capacity has been increased to a minimum 100K (the Spectrum's minimum was 85K). It's also pleasing to see that the 'Sinclair' has been simplified. To get a cartridge catalogue it's enough to type CAT_MDV1 to get a list of files

from Drive 1.

The Microdrive is a serial device which mimics actual random access. Its 100K capacity is divided into 255 sectors of 512 bytes. As with a disk drive, you simply give it a command to find a named file and it whizzes through the length of the tape and transfers the relevant sectors to the memory as it finds them. In theory, the average access time should be half the tape's loop time, though after a long period of activity when you're changing file lengths, adding new files and deleting files, the sectors for each file tend to become scattered throughout the length of the tape. Unless you're prepared to conscientiously 'housekeep', the cartridges' access time is going to be closer to 7 seconds.

The Microdrives are the key to the success of the QL. The alternative of conventional floppy disk drive storage would have doubled the machine's price. They would also have made the machine less suitable for mail-order treatment — always an important part of the Sinclair strategy. Although the Microdrives represent a considerable innovation they can not be considered floppy disk work-alikes. Instead they provide an alternative to disk usage.

When RAM memory becomes cheap enough, it will be memory reliant systems like the 68000-based QL which can take advantage of the changed ground-rules. Storage access speed will become less of a problem with 640K of memory available in RAM. Although the price of the 500K RAM pack has yet to be announced, it may well be round the £200 mark. In the long run we can expect the cost of memory to tumble even further. When this happens you will be able to load up all the information you are likely to require at the start of a session. The files should be easily accessible — quicker even than a Winchester drive.

With the 500K RAM upgrade it would be possible to have several programs sitting in memory until needed. It would



Sinclair has dispensed with the penny-pinching keyboards of the ZX days. This one still uses a touch-sensitive membrane, but the keys mimic full-travel and the QL registers a 'click' to provide some feedback.

also be possible to have several hundred K of files all loaded up and ready to access.

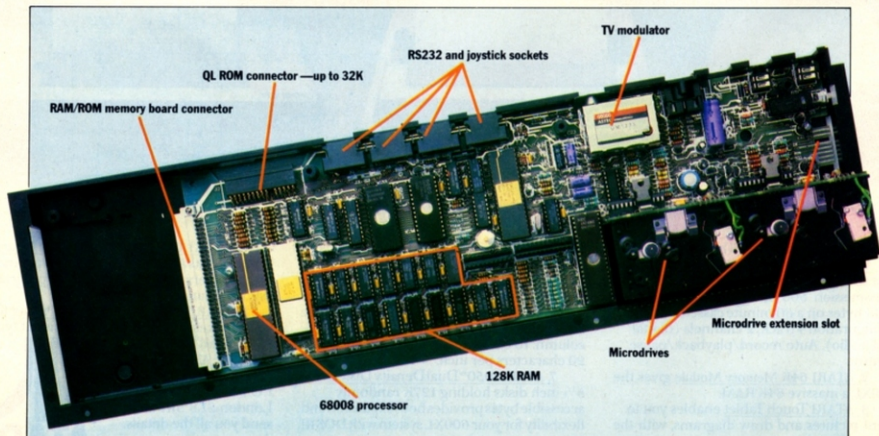
Sinclair is also talking about the addition of Winchester disk drives, though it has no plans to produce disk drives itself. It will undoubtedly be up to third parties.

The QL will undoubtedly be criticised on the grounds that the Microdrives provide neither the speed, capacity nor reliability of disk drives, therefore disqualifying the product as a serious business machine.

This criticism would miss the point...We believe the QL will succeed precisely because it has been designed to use mass internal RAM storage. For most business applications it will prove a faster and more flexible tool than any existing business micro costing four times its price.

Software

On its own the QL would have been an instant success. With four programs bundled in the purchase price it's a winner. It is no exaggeration to say that the prog-2▶



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BOOKWARE



The QL mail order package. Professional-looking documentation, power transformer and Microdrive cartridge wallet.

rams alone would, under normal circumstances, be worth the QL's £399 price tag.

But, of course, Sinclair products never represent normal circumstances. In this country at least, software prices for business micros must come down if the machines are to compete with the QL. This price move has indeed been a long time coming — it is cheap and friendly software, more than any other factor, which will eventually sort the men from the boys as the long-awaited 'shakeout' occurs.

Once you've written a software package it costs next to nothing to duplicate it — what better way to enhance a mass-produced hardware product than to give away software with it?

The key to the Sinclair operating system, QDOS, is the 'multi-tasking' capability. Multi-tasking is where you can have several programs running simultaneously. The term multi-tasking is a much used and abused term. All micros 'multi-task' to some extent. There is always a program running to display the screen and another program simultaneously reading the keyboard while the application program is doing its stuff.

The number of tasks a micro can do at the one time relates directly to how quickly it can process information. As the 68000 chip is a very powerful device it's possible for it to be doing many different things at one time without the user noticing any great reduction in speed — the processor simply executes a tiny bit of one program, then a tiny bit of the next and so on, fast enough to make it appear that it's all happening at once.

So when you have a very powerful processor you can design its software to take advantage of this capability. The four Psion packages (which we will look

at in greater depth in an upcoming full Pro-test of the machine) use multi-tasking in the form of windows. In windowing you can have two or more programs running and being displayed in separate parts of the screen at once.

Add to this the facility to transfer data from one application program to another and you can see the potential. The Psion packages enable you to display a page from the database or spreadsheet package while preparing a document on the word processor, for instance.

And then there's games — the abilities of the QL here are quite staggering. You can have as many separate graphics programs simultaneously running in different parts of the screen as you like.

According to Sir Clive the company is unsure which way users will take the machine — Sinclair was taken by surprise at the games direction of the Spectrum and is prepared to be surprised again at what applications people will find for the QL.

The QL has been designed to offer the ultimate in choices in this regard — there

are joystick ports, a games cartridge port, Microdrives, RAM/RAM expansion slot — enough hardware flexibility to assure the software applications which make use of it will go any way but down.

Forecast

It is very difficult not to be carried away by the QL. Unless it proves to have very serious faults or drawbacks when in use we can safely nominate it as machine of the year for 1984. Sir Clive has identified the demand to launch another mass-market computer, where volume sales can keep down cost and low cost can assure volume sales.

Once hooked into this spiral it's good news all round; good news for the user who will find tons of software, peripherals and like-minded hobbyists, good news for the UK as Sinclair gears up for a successful assault on the US market and shores up the unprotected UK market against the Americans and Japanese. And, of course, good news for Sinclair Research and all who sail in her — long may they prosper.

SPECIFICATION

Price	£399.00 plus postage and packaging, £7.95.
Processor.	Motorola 68008.
RAM	128K (expandable to 640K).
ROM	32K.
Text screen	Various modes — up to 85 × 25 Monitor; 1V 40 to 60.
Graphics screen	512 × 256 pixels (4 colour) — 256 × 256 pixels (8 colour).
Keyboard	Full moving 65-key qwerty, 5 function keys, 4 cursor keys.
Interfaces	Two serial RS 232 interfaces, Microdrive expansion port, ROM cartridge port, Local area network, 2 Joystick ports, RGB Monitor and TV interfaces.
Storage	Twin QL Microdrives, 100K each — transfer rate, 15K per sec.
OS/Language	QDOS, Sinclair SuperBasic.
Manufacturer	Sinclair Research. Available mail-order only from Sinclair Research Ltd, FREEPOST Camberley, Surrey GU15 3BR. (0279) 685311.

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To round off Keith Hook's guide to Memotech programming, here are the diagrams we promised.

Memo completed

The two tables presented here are an extension to Keith Hook's introductory article on programming the Memotech, which we published last week.

The Memotech offers three display modes which will handle text, sprites or more complex graphics screens, and therefore it's worthwhile spending a little time getting to know them.

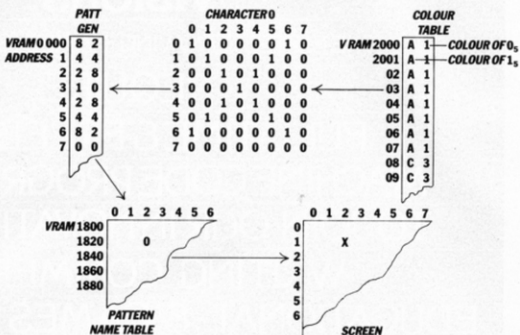
Diagram 1 shows how mode 2 operates. As there are only 256 character codes available at any one time, the Memotech splits the pattern generator table into three sections of 2048 bytes, so the 256 character names are each used three times.

Table interaction is illustrated by diagram 2. Once you can put together the various effects possible with the Memotech's screen modes, you'll see how they can be used together in programs to obtain some very startling effects.

If you missed the first part of the article, back issues are available from the PCN Back Issues Service, 53-55 Frith Street, London W1A 2HG.

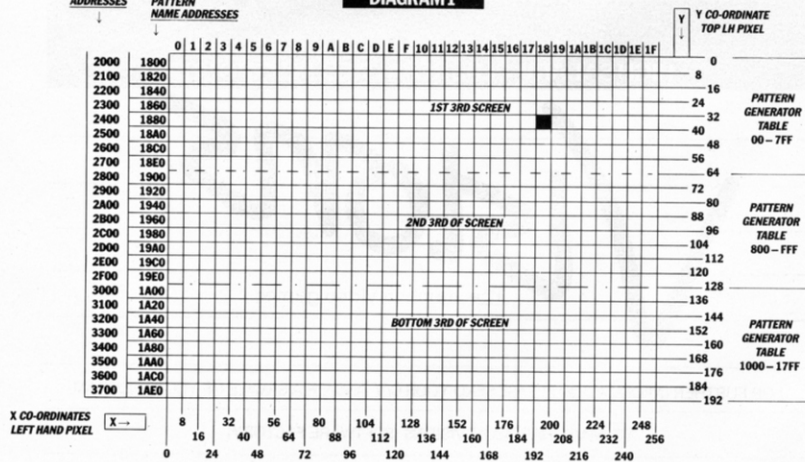
DIAGRAM 2

TABLE INTERACTION



WILL CAUSE THE LETTER 'X' CHARACTER CODE 0 TO BE DISPLAYED AT LOCATION 35 ON THE SCREEN WITH BLACK BACKGROUND YELLOW PRINT.

DIAGRAM 1



SCREEN RELATIONSHIPS GRAPHIC MODE II

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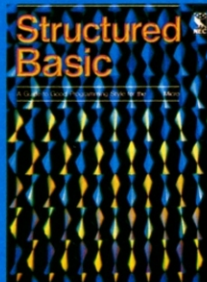
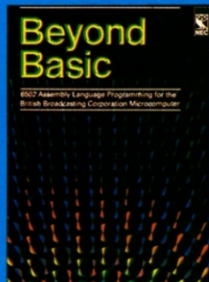
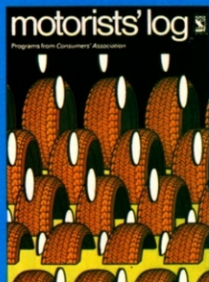
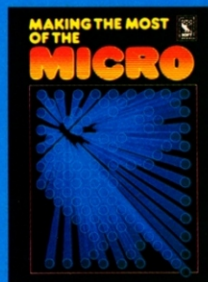
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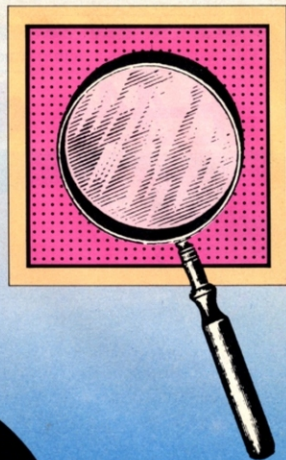
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John Lettice looks at a major advance in dot-matrix printing.

EP-44's denser dots



The EP-44 unpacked is a lightweight printer producing results comparable to daisywheel printers.

The death knell may be sounding for daisywheel printers. And who better to sound it than Brother, the manufacturer of a range of high-quality daisywheel typewriters and printers?

The Brother EP-44 is a portable dot matrix printer typewriter, but from a technological point of view its salient feature is that its print head is 24x18, which makes 9x7 look fairly puny, and produces results comparable with expensive daisywheel printers. It's a quantum leap from the EP-22, and there's more of that on the way, with the Japanese currently working on super-high density print heads, and on printers that produce full colour with the aid of three-colour ribbons.

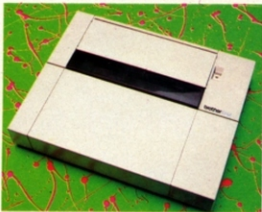
PCN reviewed the previous portable from Brother, the EP-22, last autumn, and the 44 is basically similar in design and use. It has just under 4,000 characters of memory, its text editor has been cleaned up a little, and it's send and receive. This means you can use it as a typewriter, a printer, or a remote terminal. It's not a micro though — not quite yet.

Its launch stable-mate is the HR-5, which uses the same technology and emulates Epson printers. As you'll see from our photograph, the HR-5 is around half the size of an Epson, and incidentally can run off four U2 batteries. It would be perfectly feasible to tote it around with a Tandy or NEC portable for producing hard copy.

The secret of this new breed of printers is twofold. CMOS technology allows the

EP-44 to store text in the same way as a lap portable computer does, without guzzling power. The thermal print head cuts down on the amount of power you use to actually make your mark on the paper. This either uses thermal paper to produce a creditable black image on the page, or burns a hole in a carbon ribbon for even better results. The density of the print head is great enough for the entire letter to be burnt out of the ribbon, rather than just a pattern of dots.

The trade off to achieve this print quality is the kind of paper you can use. The EP-44 did produce an image of sorts on standard office stationery, but it was fairly abominable, and for good results you've really got to use shiny-surfaced paper. Experimentation should identify some form of paper that will give acceptable quality and is at the same time of an acceptable weight, and for day to day communications the thermal paper will be more than adequate.



The 44 packed up.

Virtually in step with the micro boom, printer prices have been going through the floor over the past year or so. A number of good quality printers have recently come on the market at around the £200 mark, and the HR-5, bidding at £178, is set to cause a minor earthquake here, even excluding its low weight and classy output.

It has optional Centronics or RS232 interfaces and is capable of dumping high-resolution graphics from the screen. It's a dead ringer for a first 'quality' printer for home micro users, who, for the first time probably, will be offered full 80 column printing.

The 44 is around the same size as a typewriter, and weighs about 2.5kg. You can type into it storing your output in memory, you can operate corrected printing, which prints 15 characters in arrears — 15 characters is the size of the LCD display — or you can use direct printing, where it operates just like a typewriter.

The keys are semi-calculator in nature, but are big enough for you to build up a fair old head of steam on them.

Incidentally, this article up to here represents the total capacity of the 44's memory.

So it's a matter of printing out your deathless prose, then clearing the memory for the second volume.

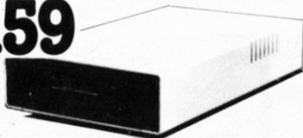
Those of you who've seen the EP-22 will notice that the black casing has been abandoned in favour of a grey and blue colour scheme. This is apparently for the benefit of the US market, not because the Americans are different from we decadent Europeans, but because almost everything in the US now seems to be made to look like a certain range of incredibly big machines, and Brother is no exception.

When used by itself as a word processor, the 44 allows you to insert or delete whole lines or single characters, and has a number of extra features which are accessed with the aid of the blue code key on the left of the space bar. You can switch on a sort of word wrapping routine by auto which starts a new line if it reads a space or a hyphen in the last six characters before the right margin. A strategically placed seven character

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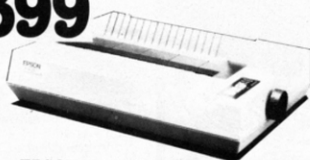


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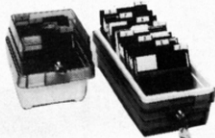
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"My appetite has been whetted and I intend to get my own copy (of Snowball) to play."

-What Micro?, Dec 83

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-HCW, 5 Sept 83

"Colossal Adventure is simply superb. Anyone who wishes to use adventures in an educational setting really must use and see this program as it emulates Crowther and Wood's masterpiece so well. For those who wish to move onto another adventure of similar high quality, Dungeon Adventure is to be recommended. With more than 200 locations, 700 messages and 100 objects it will tease and delight!"

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Colossal Adventure is included in Practical Computing's Top 10 games choice. "Poetic, moving and tough as hell!"

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"To sum up, Adventure Quest is a wonderful program, fast, exciting and challenging. If you like adventures then this one is for you."

-NILUG #1.3

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"wholly admirable"

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Please describe your Computer

HR-5 PRINTER

word mucks this up of course, which is a pest.

Tabs and margins are set fairly easily by a combination of space bar and setting keys, and you can also centre text or range it to the right of the page. A second shift allows you to print a range of exotic letters and accents, and the machine has the integral calculator the EP-22 has.

Instead of looking on the EP44 as a printer or a typewriter, you could also think of it as a dedicated word processor. Such things are becoming more common — you could think of the Microwriter as one, and dedicated handheld spreadsheets are just starting to appear in the United States. So how does it shape up in this field?

The best way to judge this is to think about what you'd use it for. If you're writing on the move, sure you could be churning out the Great American Novel 3,700 characters at a time, but even so you'd probably want to make rough notes while you were writing, and you might even want to dash off a quick letter to the bank manager without having to print out your other text.

This is where using the EP44 gets tricky, as it holds text in memory as one file. The only way you can split this up is by placing a number of stops — where the machine will stop printing until you tell it to carry on — in the text, then switching sheets of paper or switching between printing modes.

So if you were after mobile word processing, you'd probably find the 44 severely limiting quite soon. It would therefore be a mistake to think of it as a budget rival to the Tandy or the NEC, and it doesn't stand up as value for money unless you take its printing facilities into account.

The HR-5

The HR-5 uses the same printing system as the EP44, but its typeface is standard dot matrix style, rather than the flashy kind of output the 44 produces. It's based in a 9 x 9 dot matrix in text mode, and will handle 8 x 480 in bit image mode.

It measures a titchy 7in x 12in x 2.75in, compared to 12in x 14in x 4in for an Epson MX80, and weighs about 3.75lbs without batteries. It'll take single sheets of paper or 30 metre rolls of paper which sit on a detachable — exceedingly so — spindle that hangs on the back of the machine. It takes a larger ribbon cartridge than the EP44, and has optional RS232 or Centronics interfaces.

We didn't have a manual for the HR-5 at first, and spent a fair bit of time wrestling with it to try to get some kind of output. The best we got at this point was garbage, but it was very pretty garbage, and the print quality was astonishing. Brother's UK service department was very helpful, however, and gave us a series of dip switch configurations and a provisional manual. With these you can select RS232, bit length, parity, and any one of eight baud rates between 110 and 5600.

The dip switches themselves are tucked away inside the printer, under the right hand end of the ribbon. Once you have



Flip up the smoked plastic cover and you see a little of the works. The print head (between the two lugs are the front of the ribbon cassette) is pushed up against the paper by the metal bar running across the picture's centre.

them set up to operate with your particular micro this should be no great problem, but tinkering about initially with an RS232 does have a tendency to be a bit like trying to tune into Radio Tirana, and the switches are positioned so that you need a pretty thin pen even to reach the little swine.

The working HR-5 is really quite an impressive piece of work, however, giving double width, reduced, enlarged, underlined and emphasised characters, together with superscript and subscript. Despite the problems we had it shows considerable versatility, and the Centronics interface version should work at least as well as pricier competitors.

It should be clear from what we've said above that there are disadvantages with the EP44 and the HR-5, but the crucial point about both machines is that the disadvantages are there for a very specific reason. Until very recently it just wasn't feasible to have a cheap battery-operated portable printer with anything like reasonable print quality, but using heat rather than impact to make a mark on the paper has circumvented this.

Granted, the kind of paper you can use is dictated by this approach, but with a little research you can find quality paper of a weight you could use for business stationery that is at the same time glossy enough to allow the carbon from the ribbon to adhere to it. And look at what you're getting — the EP44's print head is complex enough to take a highly ornate typeface (so ornate, in fact, that Brother is quite clearly guilty of showing off in its design).

The terminal aspect is also important, giving you a facility to use the machine as a

remote terminal, possibly sending and receiving information over the phone line, and the printer partially circumvents the problem of limited memory. The memory, incidentally, is probably low because of the high price of CMOS chips, and an extra 4K would put the 44 a bit too high price-wise.

Size is an important feature of the HR-5, and this could be an important consideration for situations where space is at a premium, but this and the slightly gimmicky battery power will tend to obscure its other advantages. The print quality is as clear as most daisywheels, and if RS232 is your bag there is a great deal of flexibility in terms of baud rate and general communications there. Take the £175 price into consideration and it becomes a printer you need a good reason not to buy.

Now the final interesting thing about both these beasts is that they're still very much an interim stage. They're substantial advances on current technology, but they carry in them hints of the sort of technology we're liable to see in the future.

Printing technology will improve further until we have super-dense dot matrix print heads operating on plain paper, and the number of moving parts in printers will decrease to the extent that the main reason for the size of the printer will be the size of the paper.

And then we have the EP44, the electronic typewriter that is almost a micro. Plug in a Basic and 20K more memory and we'd have a very interesting little portable, with the added advantage of a pretty decent print out. And just a little bit more tinkering with the technology and we might have a real find on our hands.

Which book would your micro want you to buy? PCN's review page helps you choose.



Inside the Chip, by H Davies and M Wharton, **Understanding Computer Graphics**, by J Tatchell and L Howarth, **Machine Code for Beginners**, by L Watts and M Wharton, all published by Usborne, at £1.99 paperback, £3.99 hardback each 48 pages.

These three slim volumes for beginners are colourfully illustrated making them easy to read.

Robots demonstrate the tasks of the computer, some of them biking along eight pathways to eight section garages representing eight bit bytes, while others pin up notices or choose library books, depicting RAM and ROM. Colour is cut off towards the end of each book, and black and white pages bring them to a less visually stimulating close.

Understanding Computer Graphics, by far the easiest to read, begins by describing how a picture is produced on screen and includes a clear explanation of the size of memory needed to produce pictures of differing resolution and colour. The rest of the book is dedicated to practical aspects of computer graphics — simulation, computer aided design, animation and computer art. The book ends with four graphics programs to run, with conversion charts for the BBC, Spectrum, Dragon and Apple.

Inside the Chip starts enticingly with an illustration of a silicon chip beside an open tube of sweets. But the going gets tougher with explanations of registers, control circuits and logic circuits, among others. There are interesting sections on how chips are made and their origin and design. Practical circuits are included for those who like to dabble.

Machine Code for Beginners is a brave attempt to simplify a difficult subject. Having fought through the explanation you have the opportunity to test

your new-found skills by writing a simple program to add two numbers together. If you make this hurdle you are ready for flags, jumps, subroutines and conditional branches. You'll know you've arrived at this testing section of the book — it will be in black and white. NR



'Dragon Machine Language for the absolute beginner', by John Vander Reyden, published by Melbourne House at £6.95 (paperback 257 pages).

This book is for the absolute beginner, or at least, it starts that way. Early chapters explain such things as binary and hexadecimal and what a micro is. Then comes a description of the 6809, the CPU that controls the Dragon, and its addressing modes.

Much of the book is devoted to the instruction set; anyone using a 6809 on a machine other than the Dragon might consider the book for this section alone as it is comprehensive. A minor criticism is the use of the word *inherent* when the author means *implied*, as this may cause confusion in relation to other books on the subject. The descriptions in this section tend to be complex and may need repeat readings.

The final main section of the book contains example prog-

rams, starting with simple examples of the instruction set and ending up with useful routines that show how to access the Dragon's external chips, the PIA, screen, sound and so on.

The appendices are most informative, covering graphics modes, memory locations, ROM routines, ASCII codes and the instruction set summary.

This is a comprehensive book, useful for anyone trying machine code, which need not be harder than Basic. All you need is the instruction set, some idea of where to put your programs in memory, and how to get information in and out of the computer. The book covers all these features, making machine code straightforward. KG

Disk Drives for Microcomputers by Michael Browne. Published by Sinclair Browne at £7.95 (paperback, 162 pages).

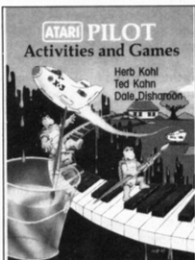
Given the number of cheap (low-priced) disk drives becoming available for formerly tape-based home computers — the Dragon, Spectrum, Oric for instance — the timing of this book is very good.

It tells you all about disk drives — their history, their physical technology and the bits of software that can be used to make them valuable additions to your system.

Central to this subject is the thorny question of file handling — Mr Browne comes down firmly on the side of ISAM (Index Sequential Access Method), and chapters include 'How to build an ISAM' and an 'ISAM Case Study'.

I like this book. It treats the

difficult middle ground between condensation and omission of crucial steps. IS



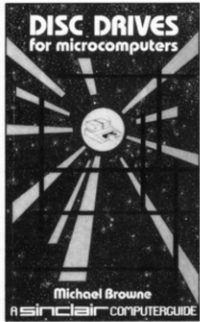
'Atari Pilot Activities and Games' by Herb Kohl, Ted Kahn and Dale Disharoon, published by Prentice Hall International, at £12.70 (paperback 250 pages).

PILOT (Programmed Inquiry Learning Or Teaching) is a computer language originally designed for use in education. To make the most of this book you'll need hands on an Atari and the Pilot cartridge, in order to try the numerous examples included.

The first chapter contains an introduction to programming in Pilot for beginners — not overly comprehensive — and the rest concentrates on facilities provided in the cartridge, such as Turtle graphics, sound commands and string handling.

Two appendices explain the codes used for special characters in the book, and give the uses of memory locations, such as how to access the keyboard and how to specify screen colours.

The programs themselves may prove particularly useful since they are easily extended and modified. KG



Pan/PCN Books were hit by disaster when a faulty printer ROM corrupted listings for 60 Programs for the Commodore 64 and 60 Programs for the Vic 20, causing an unacceptable level of program errors. The books have been recalled and corrected versions are being printed.

If you bought a first edition, send the title page to: Pan/PCN Books, 16-18 Cavaye Place, Fulham SW10 9PC, including your name and address printed clearly, and Pan will send you a replacement copy as soon as possible.

Many apologies to anyone inconvenienced by this problem.

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Now, there's a substantial new catalogue of educational programs specially for the BBC Microcomputer.

It has been developed by Acornsoft, the software division of Acorn Computers who manufacture the BBC Micro.

Making faces without getting scolded.

With the new Facemaker program, your children can make over a million faces. It's like an identi-kit, allowing them to depict anyone they want. They start by choosing the eyes. Then they can choose the mouth, the ears, the nose, the facial outline and the hairstyle.

And if they really fancy dressing up, they can add earrings and hats.

In doing all this, they learn to read and spell, as well as developing their powers of description.

The money program, two games for the price of one.

Mr. T. is an engaging little figment of the microchip who can teach your children all the complexities of our coinage system.

His Money Box program has two games, each of which can be played at different levels.

In Money Match, the challenge is to collect a set of coins, matching them according to shape, size and value.

In Money Box, you can give your child and Mr. T. a helping hand to get all the coins on the screen into the box. (It's always different, because the coins on the screen are based on the small change you have to hand.)

A chance to teach the Micro a thing or two.

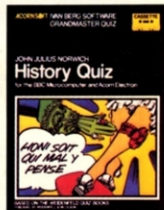
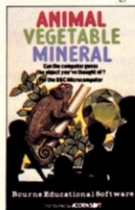
With the Animal, Vegetable, Mineral program, the children can get the computer guessing.

They think of an object. The BBC Micro has to decide what it is.

If it doesn't come up with the answer, the children can keep giving it hints.

In doing so, they are encouraged to question the difference between such things as crocodiles and alligators, or whether oil is vegetable or mineral.

The program also encourages them to consult refer-



ence books so that they can ask the computer increasingly tough questions.

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ACORNSOFT



Piers Letcher finds finger painting takes on a totally new dimension with this touch-sensitive tablet.

An electronic canvas



One of the most interesting of Atari's new range of peripherals is the Touch Tablet. At just below £70 it brings the field of computer art within reach of most micro owners.

First impressions

The Touch Tablet is small, (8in by 9½in) light and plastic. Unfortunately it looks as though it might break easily. It comes well

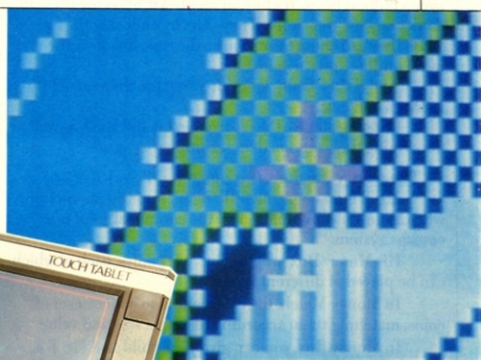
packaged, complete with booklet, stylus and a cartridge containing Atari Artist.

There are push buttons on either side of the tablet, and also on the stylus. These are all used to control when to draw and as toggles between the menu and the picture being drawn. This means that this peripheral is equally easy to use for both left and right handed people.

The tablet is covered by a thin sheet of

transparent plastic which protects its surface and allows you to put drawings to be traced underneath it. The latter function was not very successful, as tracing is hard to do without leaning on the tablet and since your hand also acts as a 'brush', the tablet gets confused.

Setting up the tablet is simplicity itself. The cartridge is plugged into the Atari, the stylus is plugged into the tablet, and the



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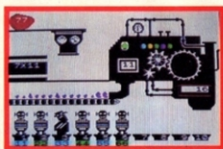
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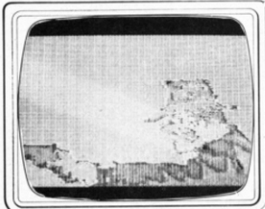
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37 tablet is then plugged into the Atari. The model used for this review was the Atari 600XL.

Documentation

Due to the nature of the tablet and its accompanying software the tablet needs



Freehand graphics and fill commands can be used to draw cartoon style pictures.

little documentation. By experimentation alone you can discover the full range of possibilities; it is even possible to use the tablet for some time before needing to read the manual.

The version of the manual we had was an early draft, but its thoroughness explained the Atari Artist's features clearly and in detail.

Features

The main feature of the tablet is its low cost. A package that offers tablet, stylus, manual and cartridge software at this price is in itself remarkable.

The Atari Artist cartridge contains all the features you would expect from an artist package. A selection of different brushes, colours and shapes, plus a series of routines to perform specific functions — fill, mirror, load and save are included.

In use

Switching on the Atari with the Touch Tablet and the artist cartridge plugged in presents you with the screen from which you can run the whole program using the stylus and push buttons — the keyboard duplicates some of the functions but is not necessary to make the tablet work. You can also use other drawing instruments like a pen or even your finger to select from the menus.

After the welcome screen you will either be in the help menu or the main menu, depending on what has been selected. Although the help menu is one of the



The mirror option can be used to give vertical, horizontal, diagonal or 4-way reflections.

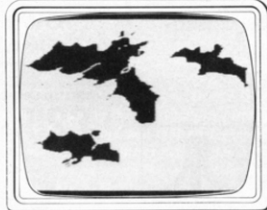
simplest ways to get started, I went straight into the main menu which is displayed as a series of pictures with accompanying words.

Selection of an option is simple. Moving the stylus around the tablet moves a corresponding cursor across the screen. Pressing one of the control buttons selects the option to which the cursor is nearest. To get onto the 'canvas' just lift the stylus off the tablet and press one of the control buttons. This works as a toggle, and when you lift the stylus and press a control button you switch between the canvas and the main menu.

The options fall into several distinct categories. One group selects the type of brush to draw with, this is much the same as having a selection of pen nibs to choose from. Experimentation is the best way to find out the effects of each of the eight 'nibs'.

Another group selects the current colour being used. This is very similar to a palette since there are four main colours — background plus three — and underneath this you have mixes of these colours which are created by having alternate pixels of different primary colours.

The last group of options controls whatever is being drawn. A simple *Draw* command allows you to use your current



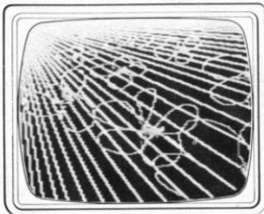
Changing the background can give interesting effects.

nib and colour to draw on the tablet as you would on a piece of paper. A *Point* command allows you to put points, or the current brush shapes onto the screen one at a time. This is useful for adding fine detail to a picture at the end, and can be used with the *Magnify* function to give great accuracy.

A *Line* command lets you touch the stylus to one point, press the button to mark it, and then move the stylus giving a specimen line in any direction and of any length. The *K-Line* function extends this so that it is possible to have a series of interconnected points just by marking them on the tablet.

The *Rays* function gives you the opportunity to paint with rays outwards from a point, and is fun to use though it takes a while to become accustomed to the way it works.

Circles, squares and rectangles can be drawn with the *Circle* and *Frame* function. Both use the rubber banding principle, you can see what the result will look like before you decide to fix them permanently. *Disk* and *Box* have the same option, but filled in



The rays feature can be used to strong effect.

with the current colour. These commands are particularly useful if you need to erase a particular portion of the screen without losing the whole picture.

Several other utilities are provided. The most useful of these is the *Fill* routine. This fills in any enclosed area with a selected colour and is very fast, particularly when compared to colouring things in by hand.

Another utility that adds more scope to the software package is the *Mirror* function. This makes the reflection of what you are drawing appear at the same time as the original. You can select a diagonal, vertical, horizontal or 4-way reflection. Only this and the *Magnify* option can be used in conjunction with the other options. Selecting *Magnify* means you can work on the picture pixel by pixel as a small portion of the picture is enlarged.

The whole picture can be cleared with the *Erase* option, this has a sensible check in it to prevent accidental loss of the picture.

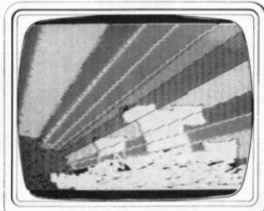
The last option is the *Colour Menu* which changes each of the colours and the brightness to the precise level required. There are 128 colours available.

Once you've made a picture you can save it using the *Storage* option on the menu. Pictures can be saved to disk or cassette.

Verdict

At £69.99 inclusive the Touch Artist is a reasonable price and brings the ideas of graphic art on micros within reach of the home micro owner. The upgrade of the tablet, the light pen, is already planned, and should be even cheaper.

The tablet is easy to use, entertaining and quite addictive. The permutations are large, and the quality is almost good enough for professional graphics design.



Using rays, fill and circle functions to create sunset.

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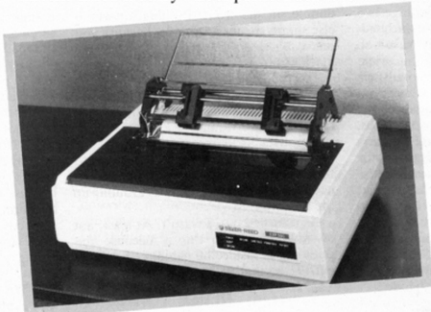
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Low-cost quality

David Williams finds a daisywheel printer for less than £300.



A daisy wheel printer for under £300? Impossible I can hear you saying, but the Silver Reed EXP 500 is a dedicated daisywheel printer, which can be connected to most micros with a parallel or serial printer interface, and it costs just £299 for the former and £349 for the latter.

The model I tested was provided with a parallel interface and worked with the BBC Micro.

First impressions

The printer comes in a sturdy cardboard box with the inevitable moulded polystyrene packing. The basic machine is supplied with a Courier 10-pitch daisywheel, a carbon multistrike ribbon cassette and a power lead, but no plug.

The printer is light grey with a smoked plastic printhead cover, which also acts as a barrier for the unwary fingers since a microswitch under the cover automatically turns the machine off if it's opened.

The instructions are contained in a glossy 27-page book which makes setting up and getting it going no great problem. Care must be taken to take off all the packing and to remove two screws located in the base of the machine which hold the carriage in place.

The controls are simple, with an on/off switch located at the rear of the machine immediately above the power cord. On the front of the machine are four buttons, clearly labelled for On Line, Line Feed, Form Feed and Top of Form Set. Three LEDs warn you of the machine's state of play.

Under the cover immediately behind the front control panel are five DIP switches used to change the printer's printing modes. One switch controls the length of Form Feed. Disappointing, since you only have the option of 11 or 12 inches. Two of the switches allow a configuration for different print wheel pitches, 10, 12 or 15 cpi. The fourth switch turns a line feed on, carriage return on or off, and the fifth

switch is to set the printer in either serial or line mode.

After switching on you can generate a self test of the operating system which produces Figure 1.

As you can see, the daisywheel supports a full character set including super and subscript, and computer characters such as [and] .

A feature on the machine is the ability for it to print in bold face, underline and limited graphics.

In use

Once I had placed some text into the computer I was ready to go. My first impression was the relatively quiet performance. Although obviously noisier than a dot matrix, the EXP 500 is considerably quieter than many other printers I have come across, including some costing many hundreds of pounds more.

Inserting paper into the machine is easy, as is lining it up properly. Touching the Form Feed, however, is an unforgettable experience. It is extremely vicious and the paper shoots out of the top of the printer. The platen was a little stiff, but that's no bad thing and it will probably ease up with use.

The printer works bi-directionally when in the line input mode and uses a line buffer. Serial mode, however, gains access to all the control codes within the machine and underlining is simply performed by inputting X number of backspaces followed by X number of characters. There is a Basic program provided within the manual for you to put this to the test, as well as one to try out the type, since that works on a similar principle to the underline.

Three daisywheels are available for use with the EXP 500, in 10-pitch, 12-pitch, and 15-pitch, the pitch being the number of characters per inch. The recommended typefaces on the wheels are Courier 10 and 12 and Gothic Mini 15. These particular

daisywheels are Diablo compatible and have the required characters on them to operate most word processing programs, such as Wordstar.

However, I tried out other daisywheels from the same manufacturer which I use on my typewriter. Figure 2 shows the results.

Some of the characters don't print, and others come out with some surprising results. However, all the normal alphanumeric characters appeared to work all right, so for printing letters etc you do have a wider choice of print options.

Verdict

The quoted speed is 14cps but the print style, as is to be expected on a daisywheel, is clear and precise and using it will give you a far better print than even the most sophisticated dot matrix printer. At the price of £299 from C/WP Computers the EXP 500 is unbeatable.

Product EXP 500 printer **Manufacturer** Silver Reed (0923-45976) **Supplier** C/WP Computers (01-828 9000) **Price** £299 inc VAT & 12 month guarantee; serial interface £50 extra **Outlets** Retail

Figure 1: Sample printout from the self-test routine using the daisywheel supplied with the machine.

```

RSTUVWXYZ [\]^_`abcdefghijklmnopqrstuvwxyz
3TUVWXYZ [\]^_`abcdefghijklmnopqrstuvwxyz
IUVWXYZ [\]^_`abcdefghijklmnopqrstuvwxyz
JUVWXYZ [\]^_`abcdefghijklmnopqrstuvwxyz
KUVWXYZ [\]^_`abcdefghijklmnopqrstuvwxyz
LUVWXYZ [\]^_`abcdefghijklmnopqrstuvwxyz

```

Figure 2: A similar sample using a non-standard wheel show the alternative characters available.

```

RSTUVWXYZ>µ<&_ ]abcdefghijklmnopqrstuvwxyz
3TUVWXYZ>µ<&_ ]abcdefghijklmnopqrstuvwxyz
IUVWXYZ>µ<&_ ]abcdefghijklmnopqrstuvwxyz
JUVWXYZ>µ<&_ ]abcdefghijklmnopqrstuvwxyz
KUVWXYZ>µ<&_ ]abcdefghijklmnopqrstuvwxyz
LUVWXYZ>µ<&_ ]abcdefghijklmnopqrstuvwxyz

```

Apple alternatives

Cheaper data storage is desired by the droves of Apple owners. What's Richard King driving at?

The price per bit of data storage is a subject which doesn't make the headlines much these days. It wasn't so long ago, however, that it was a prime topic... and for Apple users, who still face paying a very considerable sum for a brand-name Apple drive, it should still be.

However, alternatives are available, and in almost all cases these are not only cheaper, but frequently smaller, faster or higher-capacity than the pukka article.

We decided to look at a couple of these, Alps which is supplied by C/WP Computers and the Aviette 820 from Tashkl Computers. Both are functionally identical to an Apple drive, and provide 35 tracks, which in the Apple disk-format represents 143K of formatted storage.

First impressions

Following modern trends, both are 'one-third' height. My ruler measures a standard Shugart drive at a shade under nine centimetres high, and these skinny ones at half a shade under 4½ centimetres.

Both drives are the normal width, but the Alps is considerably longer than the Aviette. This is to accommodate the electronics — on a small board in the back of the Alps casing, whereas they're mounted above the Aviette chassis.

As usual, the casing is a simple folded metal sheet which is bolted on underneath, and which like almost all computer peripherals is sprayed a moderately unspiriting buff colour. It's amazing, though, how many variations on the theme there are... almost every manufacturer seems to have its own special mix.

Internally, they are very different. Both share the metal band-positioning mechanism, which moves the head back and forth, but otherwise there's not much similarity.

The most noticeable difference is in the main clamping mechanics. In the Alps it's much the same as the Shugart, with a sprung arm running from the front of the drive right through to the back, which carries the floating bush which actually clamps the centre of the disk, as well as the front door of the drive. An addition is the inclusion of an ejector-mechanism which is fired by pushing slightly on the centre of the drive-door... this pops up, and the disk then springs out a bit.

The internal arrangements of the Aviette, which is actually a Tandon, are totally different, and the first sign of this is the locking-lever on the front. This is similar to the drives which have been used in a fair proportion of recently-released machinery, on which the action of lifting the lever fires the ejector mechanism.

Construction

I'm not so keen on the Aviette version, mostly because there's only one place where the disk can be pushed — in a little

dimple on the front. Pushing anywhere else simply means a struggle, because you just can't depress it enough to lock the mechanism.

The design is also supposed to be more reliable, but since I strongly suspect that they are talking about statistical reliability rather than individual.

A noticeable feature was the absence of the shielding-strap which is laminated to the cable of the Apple drive. My conscience still pricked me a little: was I fouling up the airwaves?

As it turned out, I wasn't. At least, not on my radio, and this is because the shielding is inside the cable, rather than outside, so that's where the strap went.

In use

To check out their performance I rigged them up two ways, once as drives 3 and 4 in Slot 5, and once as drives 1 and 2 in Slot 6. The first arrangement is the most likely, since these drives will probably be bought as add-ons, in which case their performance is much less critical. If either goes down it will simply mean that some tasks become more cumbersome.

However, if they are bought as the main drives, as in the second arrangement, then they must be much more reliable, which made it worth treating them in both ways. As it turned out, this was helpful, because though they would read and write perfectly well, under ProDOS they both refused to format, coming back with a report that 'the drive is too fast.'

Upon running a speed-check, it turned out that the Alps drive was running about 10 per cent fast, which meant that it needed adjusting. Dead easy, as it turned out... there's a little hole on the underside of the

casing, and putting a 2.4mm flat-bladed screwdriver in this and turning gently until the reading on the speed-check remained within plus or minus 2 per cent was all that had to be done, and afterwards ProDOS accepted it without a murmur.

Not so easy on the Aviette, though. In fact, not possible. No holes, no screws to turn. Not even inside the casing (after voiding the warranty by opening the case). In fact, it didn't matter, as it turned out, because when I used the ProDOS filter to try formatting a disk again, it worked perfectly. Hmmm!

Of course, if anything major had been wrong with either drive, it would have meant a trip back to the workshop.

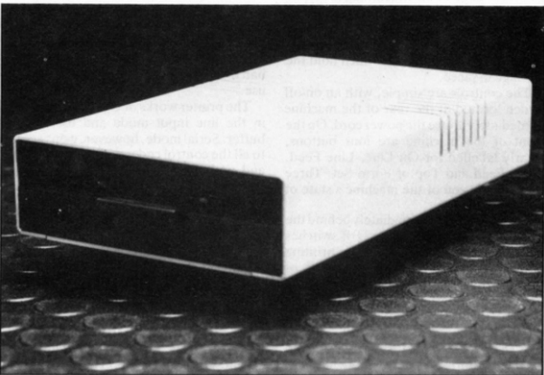
C/WP was very helpful on the phone, and explained what to do to correct the problem, as described. Tashkl was just as helpful, and said that its policy would be to send a new drive to the customer, who would only then be asked to return the drive, thus eliminating any problems caused by having no drive available. A civilised solution.

Verdict

Overall, I found that both units worked well once the small problem of speed on the Alps was attended to; either of these drives is a perfectly acceptable alternative to the standard Apple drive.

Product Alps disk drive **Manufacturer** Alps
Distributor C/WP Computers, Willow House,
Willow Place, London SW1P 1JH 01-8289000
Machine Apple II **Price** £159 inc VAT.
Product Aviette 820 disk drive **Manufacturer**
Tashkl Computer Systems, 24 Logan Road,
Wembley, Middlesex 01-9044467 **Machine**
Apple II Price £220.80 inc VAT.

Below is the Alps drive, slim and cheap, but a little on the long side. The Aviette is very similar — both even share shades of the same buff colour.





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ATARI FAMILY TREE



Atari was born when Nolan Bushnell created Pong, the first arcade game.

After a shaky start, the company was bought by the massive Warner Brothers and about eight years ago the first Atari games console was released.

It was the first 'programmable' video game console and quickly became the best selling game in the world. It is for this reason that Atari became known as a games company and the release of the 400/800 computer range in America about four years ago was supposed to launch Atari into the serious computer market.

Although the computers were top sellers in America, Atari's games image hindered the sales of its micros in this country when the 400/800 range was released here about three years ago.

The Atari 400 was originally supplied without the Basic language which probably furthered its games image.

In order to keep up with a fast-moving market, Atari had to continually cut its prices to match new computers being released with similar facilities. After three years the Atari 800 has now dropped to £199 including Basic and 48K, a drop of £630 at the old prices.

Unfortunately for Atari, while the prices of its computers had to fall, the cost of production would not drop at the same rate. The computers were manufactured on at least six circuit boards.

The luxury design of the 400/800 range caused Atari price-war headaches, and is the major reason why Atari brought out its new computer range with a futuristic and stylish image and a design with all of the components on a single circuit board.

Atari now dispensed with the much criticised membrane keyboard, fixed a few bugs in the operating system and the Basic, and revamped the Atari 400 into the Atari 600XL, with many additional features. And the 800 has now been replaced by the 800XL (a 600XL with 64K of RAM built in).

Many people looking for a computer now seem to be interested mainly in the expandability of their potential purchase. The fact that Atari has recognised this is shown in the design of the new machines. The 600XL is upgradable to 64K RAM. An expansion port (not built onto the 400/800 range), is also included for such goodies as a CP/M operating system, 80-column expansion etc.

The Atari 400

The first in the Atari computer range, the 400 was originally released with the then maximum 8K of RAM. Now upgradable to 48K the only real criticism still levelled against this machine is its membrane keyboard.

The 400, like the 800, has four joystick ports

From top: the Atari 400, Atari 800 and Atari 600XL.

along the front. There are not many programs that can use this many ports but, using paddle controllers, it meant that up to eight people could play a game simultaneously.

The 400 and the 800 both have 10K of ROM and an 8K Basic ROM cartridge is also included.

Atari solved some of the problems of a membrane keyboard using simple things like raising the edges of all of the keys and using a built-in speaker that would beep every time a key is pressed, and a number of full stroke keyboards are now available for £40.

The keyboard itself is of the standard qwerty type and four 'function' keys are included down the right hand side. The first of these, the SYSTEM RESET key, is an 'if all else fails' alternative, resetting the entire system and returning certain locations to their standard (default) values. The next three, usually used in games, are OPTION, SELECT and START and can be read individually or in different combinations.

The 400 has a cartridge port in the top of the machine, covered by a spring-loaded door that turns off the computer when opened to protect circuits while cartridges are being inserted and removed. To the right of the machine is the power switch and an Atari serial interface for connection to Atari printers, interfaces, disk drives, program recorders etc. A non-detachable RF cable comes out of the back of the machine for connection to a standard television set.

The Atari 800

Second in the Atari range of computers, the 800 is the more professional of the originally released models. Still with 10K of ROM, the 800 is more expandable by means of a lift-off top that allows you to add memory boards easily (although the last 800's were supplied with the full 48K). Other American companies have also released add-on boards including an 80-column board, a CP/M board, and one which will add 64K of RAM to the existing memory.

The 800 has two cartridge slots and is the only Atari computer to have them both. The second port was designed at a time when the largest amount of memory that would fit on a cartridge was 8K and the second slot was supposed to take an additional cartridge to provide 16K extra ROM.

In fact, the only cartridge currently available that can use this slot is one called *Monkey Wrench*. This program is an expansion of Atari's Basic adding extra commands etc.

The power switch, RF cable and serial port are the same as the 400 but there is also an output for colour monitor. This monitor should be of the composite video type and not RGB.

As with the 400, the power supply is also a separate unit and there are four joystick ports on the front of the machine. These ports can be, and have been, used for output as well as reading joysticks. Hardware such as printer interfaces have already been developed using these ports.

The only 'odd' key on the 400 and 800 computers is the Atari symbol. Pressing this key reverses the text to give blue text on a white background. This key has been replaced on the XL range by the less confusing symbol of a square half white and half black.

The Atari 600XL

The first of the new generation of Atari home computers, the 600XL is the lower priced of the models currently available. The 600XL was released just before Christmas giving a more professional alternative to the Atari 400 at a similar price.

Unlike the 400/800 range, the 600XL has the Basic language built into the computer and the cartridge door has been replaced by a hatch with spring-loaded dust covers.

The two joystick ports are located on the left of the computer. The power switch is on the back of the computer along with a socket to connect it to a composite video monitor.

The power supply for the XL range is larger than the old style one, it is quiet and is much less likely to suffer from overheating.

The Atari serial port is still included although it is on the back of the 600XL. In addition there is a special expansion bus that will allow the addition of extra cards such as 64K, 80 columns and so on.

The 600XL is supplied with 16K of RAM as standard and can be upgraded to 64K. The machine also has a total of 24K of ROM in the form of a 16K operating system and the 8K Basic. The larger ROM in the new machines supports extra Graphics/Text modes in Basic.

Software that used the old operating system bugs to take short cuts will not work on the new machines. The number of programs discovered that do not work is about 10 per cent.

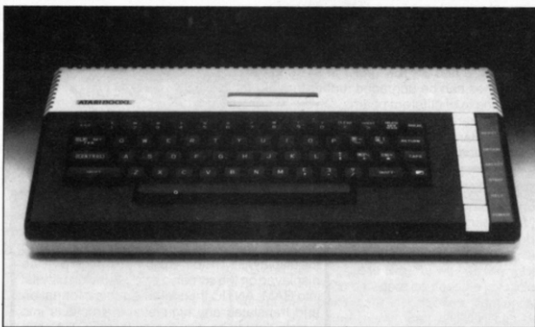
The Atari 800XL

The 800XL is identical in all respects to the 600XL except that the machine is supplied with the full complement of 64K RAM built in. This makes the case a little longer and bulkier than that of the 600XL. The prices of the 800XL and that of the 600XL with the 64K expansion are almost the same. Obviously the 600XL allows you to start using an Atari machine at a comparatively low price. After using the 16K machine for a while you may decide that 64K is not necessary and you would have saved yourself almost £90.



This is Nolan Bushnell, the man who founded Atari and the video game industry with his Pong TV and arcade games. He sold Atari to the giant Warner Communications, which then turned it into one of the most popular home computer producers in the US, and a force to be reckoned with in the UK.

Nolan Bushnell, meanwhile, has been busy developing robots for use with home computers. He has recently lent his name and support to the Androbot devices: Topo and FRED — which will be sold in this country by Prism Microproducts.



This is Atari's latest computer, the Atari 800XL — with 64K RAM and built-in Basic it ranks as the most powerful of this range of machines and the most expensive — £259 as of February 1984.

Power Socket

All Atari computers have external power supplies. The power supply is what is most likely to fail in a computer system and an external one can avoid problems. Also, any heat generated by the power transformer as well as any dangerous voltages are kept away from the computer itself. On the 400 and 800 the power socket is a small jack-type connector; this has been replaced by the sturdier seven pin din socket. The power transformer on the XL range has been updated to a larger type that seems to operate at a lower temperature.

Monitor port

All Atari micros apart from the 400 include a port for the connection of the machine to a proper monitor as opposed to an ordinary TV set. This socket is for a five-pin din plug and is for composite video standard monitors only. There are currently two main monitor standards on the market at the moment; composite video as used by the Atari range, and RGB as used by micros such as the BBC.

GTIA

The GTIA chip is controlled mainly by ANTIC, though the 6502 can be programmed to intervene. The function of this chip is to translate the digital commands from the 6502 or ANTIC into the signal that is sent to the television. This chip is also responsible for the Atari's powerful sprite graphics known as player/missile graphics.

RAM chips

The numbers and positions of the RAM chips vary from machine to machine. In the old range of Atari computers the RAM was plugged into the machines in separate memory boards. The machines were last supplied with 1x16K board in the 400 and 3x16K (48K) in the 800. Both machines can be upgraded further through the plugging in of different boards. On the XL range the chips are mounted on the main circuit board which is larger on the 800XL than the 600XL to accommodate the extra chips.

Antic

The ANTIC chip is dedicated to the screen display based mainly around a program called the display list. The 6502 places information to be displayed on the screen as well as the display list into RAM; ANTIC then retrieves this information and translates any high-level instructions into simple data to be acted upon by the CTIA chip. ANTIC, POKEY and CTIA are three chips designed and developed by Atari for use in their home computers.

The TV Port

It is from this port that an RF cable takes your micro's signal and transfers it to the aerial socket on your TV set. This connection is internal on the 400 and the 800 and it seems that Atari decided that they would make this connection on the outside of the machine.

The 6502 Processor

The Central Processing Unit of the Atari is a 6502 running at 1.79 MHz. This is the type of processor found in such machines as the BBC and Commodore 64. The processor is the same for all of the Atari range of computers although on the 400 and the old-style 800 this chip was situated on a separate 'mother board'.

Cartridge Port

All of the Atari computers have a cartridge port. The old-style 800 had two ports. The second port was intended to be used primarily for large programs that would not fit on one cartridge. As the amount of memory that can be stored cheaply on one cartridge has increased, Atari decided not to include a second port on any of the XL range. The slot could be used for almost any type of memory or interface but it is primarily used for games cartridges (of which there are more than 200 available at the moment), language cartridges (Basic, Microsoft Basic, Pilot, Logo and so on) and other program cartridges. On the XL where Basic is built in, the plugging in of a cartridge cuts out the Basic and substitutes its own program.

The XL Expansion Port

This port is included only on the XL range and is one of the major main differences between the old and the new ranges of Atari computers. This port is designed to make the XL range as expandable as possible. Whatever the developments in the micro field, this port is designed to let the Atari use them. The edge connector has 25 lines on each side of it and the only expansion currently available is the 64K memory expansion for the 600XL. This port is likely to be used for further expansion cards such as an 80-column display.

Peripherals interface

On the entire range of Atari computers there is a peripheral interface. This interface is non-standard, used mainly by Atari's own peripherals. Various interface boxes are available giving more standard interface connections to, for instance, non-Atari printers or acoustic coupler modems for telephone connection. Atari's own peripherals include a disk drive, program recorder, three types of printer and its own interface box. Apparently there are plans for a C/PM operating system module to be released which will attach to this port, giving compatibility with the already huge range of C/PM business software.

POKEY

The POKEY chip handles input and output (I/O). Among the areas that this chip takes care of are the scanning of the keyboard to check to see if a key has been pressed, the generation of random numbers, the serial I/O bus, digitisation of the paddle controllers, resistors and interrupt requests from peripherals. This chip is also responsible for the generation of sound.

Joystick Ports

On the XL range there are two joystick ports. Originally, Atari fitted its 400 and 800 with four ports but as the extras were not greatly used the XL number was cut to two. As well as the wide range of Atari/Commodore compatible joysticks that fit these ports, paddle controllers, light pens, touch tablets and many other add-ons can be fitted. The ports don't have to be used just for controllers either. Robots can be connected, speech digitisers and a printer interface are also available.

```

10 REM DEMO PROGRAM 1 - FOR/NEXT LOOPS
20 GRAPHICS 0
30 FOR A=1 TO 50:REM START LOOP TO COUNT
  TO 50
40 PRINT A*2+A:REM USE A WITHIN LOOP
50 FOR B=1 TO 10:REM LOOP WITHIN A LOOP
60 NEXT B:REM FINISH LAST LOOP FIRST
70 NEXT A:REM FINISH OUTER LOOP

```

```

10 REM DEMO PROGRAM 2 - IF/THEN AND GOSUB
B AND GOTO
20 ? "ENTER A NUMBER FROM 1 TO 5 " : INPUT
  A:REM GET A NUMBER
30 IF A=1 THEN ? "HELLO":RUN :REM COMPARE
  INPUT NUMBER TO 1, IF NUMBER DOES NOT
  EQUAL 1 THEN CARRY ON WITH LINE 40
40 IF A=2 THEN GOSUB 100:RUN :REM GOTO A
  ROUTINE AT 100 IF A IS EQUAL TO 2, WHEN
  THE PROGRAM RETURNS IT WILL RUN.
50 IF A=3 THEN GOTO 80:REM SEND PROGRAM
  ELSEWHERE IF A=3
60 IF A=4 OR A=5 THEN ? A:RUN :REM IF A=
  4 OR 5 THEN THE PROGRAM WILL SIMPLY PRINT
  A.
70 ? "YOU DIDN'T ENTER A NUMBER FROM 1 TO
  5":REM PROGRAM WILL HAVE GOT HERE AUTOMATICALLY
  IF A WAS NOT IN RANGE
75 RUN
80 ? "THE PROGRAM JUMPED TO HERE":RUN
100 REM SUBROUTINE
110 ? "YOU REACHED THE SUBROUTINE":RETURN

```

```

10 REM DEMO PROGRAM 3 - INPUT
20 DIM A$(20)
30 ? "HELLO WHAT IS YOUR NAME " : INPUT A
  $:REM ENTERING A STRING INTO A$

```

```

40 ? A$:" IS A NICE NAME":REM USE INFORMATION
  THAT WE INPUT
50 RUN :REM START AGAIN

```

```

10 REM DEMO PROGRAM 4 - ARRAYS ETC.
20 DIM A$(20),A(20),B(10,10):REM ALLOCATE
  SPACE FOR ARRAYS
30 A$="THIS IS A STRING":REM FILL SPACE
40 FOR T=2001 TO 2020:A(T-2000)=T:NEXT T
  :REM FILL ARRAY WITH NUMBERS
50 FOR X=1 TO 10:REM START LOOPS TO FILL
  MATRIX
60 FOR Y=1 TO 10
70 B(X,Y)=X*Y:REM FILL MATRIX
80 NEXT Y
90 NEXT X
100 ? "TO LOOK AT THE STRING TYPE 'PRINT
  A$'"
110 ? "TO LOOK AT AN ELEMENT OF THE FIRST"
120 ? "ARRAY, TYPE 'PRINT A(x)'"
130 ? "TO LOOK AT AN ELEMENT OF THE MATRIX"
140 ? "TYPE 'PRINT B(x,y)'"

```

```

10 REM DEMO PROGRAM 5 - GRAPHICS ETC.
20 GRAPHICS 7+16:REM SELECT A MODE WITHOUT
  THE WINDOW
30 COLOR 2:REM SELECT WHICH COLOUR WE WISH
  TO USE
40 PLOT 10,10:REM PLOT A STARTING POINT
50 FOR A=0 TO 91 STEP 2:REM START LOOP
60 PLOT 10,10:DRAWTO 150,A:REM DRAW THE
  LINE
70 NEXT A:REM CLOSE THE LOOP
80 GOTO 80:REM STOP THE COMPUTER RETURNING
  TO GRAPHICS MODE 0

```

AN A TO Z OF ATARI BASIC

We start our introduction to Atari's Basic with a look at 15 of the more commonly used keywords from the range A-K. All keywords must be entered in upper case letters.

The fifteen included here are: FOR/NEXT, ENTER, INPUT, COLOR, INT, DRAWTO, IF/THEN, GOSUB, CLOAD/CSAVE, ASC, CHR\$, GRAPHICS, DIM, ASC, CONT.

There are more than 80 keywords in Atari Basic; many are to handle mathematical functions. All keywords can be abbreviated to two letters and the most common

ones can be shortened to just one letter followed by a full stop.

FOR/NEXT

The FOR/NEXT combination in Atari Basic is much the same as it is with most other variations of Basic and it includes the option of a STEP variable. The command FOR sets up a loop using a variable to name it and a variable or a number to tell the computer how many times to follow it.

The 'var' gives the loop a name and 'num1' tells the computer what number to

start counting from. The 'num2' is where the computer has to count to before the loop is finished and the 'STEP num3' is an optional addition that can be used to alter the rate of counting from the default of 1.

The NEXT part of the combination tells the computer that the loop has completed one cycle and can add one to the counter and return to the start of the loop. If the counter reaches 'num2' then the loop will stop and the program will continue at the statement following the NEXT statement. (See program 1).

IF/THEN

The IF/THEN combination tests for a given state to be present, it looks like this:
IF EXP THEN line no keyword

The 'exp' will be an equation of some sort. If the result proves to be true then the keyword after the THEN statement will be acted upon. THEN can also be followed by a line number. If the equation is false then the program will continue at the line following that on which the IF/THEN combination occurs. An example is shown in program two.

CLOAD/SAVE

These commands can be used either within a program or on their own to save or load programs using the program recorder. After entering CLOAD the computer will produce one beep. This is a signal to remind the operator to press PLAY on the recorder and then press RETURN on the keyboard. Providing that the tape is properly positioned the program on the tape will be transferred into memory.

Use of this command erases any program that may already be in memory.

A common use of this command within a program is to chain several Basic programs together, (as used by Atari in their conversational language courses).

The CSAVE command operates in the same way except that the computer produces two beeps to remind you to press both PLAY and RECORD and then press RETURN. The program currently in memory will then be transferred to tape.



ENTER 'C':

This command is used primarily to load information into the computer without erasing what was already in memory. Any information needed to be loaded in this way must have been saved with the LIST 'C' or LIST 'D' command. This command is mainly used to merge cassette or disk files but it could also be a way of verifying cassette-saved files before erasing them from memory. The 'C' is replaced by a 'D' for disk files.

```

R. RENAME FILE      M. RUN AT ADD
L. LOCK FILE       N. CREATE MEM
U. UNLOCK FILE     O. DUPLICATE
H. WRITE DOS FILES

SELECT ITEM OR [F10] FOR MENU
A DIRECTORY--SEARCH SPEC,LIST FILE

DOS      SYS 019
DIR      SYS 042
MYFILE  BAS 001
FILE1   BAS 001
FILE2   BAS 001
FILE3   BAS 001
FILE4   BAS 001
NAME1   DAT 001
NAME2   DAT 001
NAME3   DAT 001
NAME4   DAT 001
$1.7 FREE SECTORS

SELECT ITEM OR [F10] FOR MENU
  
```

INPUT

Normally only used within a program, the INPUT command accepts data from the user of a program. As with most computers the INPUT can accept numbers or letters though unlike some Basics the INPUT cannot be used to display information at the same time, eg:

```

INPUT "Hello, what is your name" AS
will not work. Instead you must use:
PRINT "Hello, what is your name";:INPUT AS
  
```

Also the INPUT command always prints a question mark (?) to show where the text to be input will appear on the screen. If more than one input is required at the same point you can use INPUT A,C,X\$. When this appears on the screen you can enter three variables separated by commas, or you can enter each variable separately. INPUT also allows you to INPUT from a filename. See program 3.

INT

This command will return the INTEGER value, that is, the nearest whole number value to the number specified. For example X=INT(4.3367) will place the number 4 in the variable X. In effect it rounds numbers down to the nearest integer. When dealing with negative numbers, the reverse is true. INT(-3.62) will return -4.

DIM

The purpose of the DIM statement is to reserve space in memory for use with strings and numeric arrays. Unlike many other Basics, Atari Basic does not allow you to have an array or matrix of strings though other commands are available to help you around this problem. Atari Basic is also different from most others in that all strings must be first dimensioned before they can be used.

Using DIM you can produce three types of reserved memory: a string; a simple array which reserves six bytes of memory at each position to hold a number, and a two-dimensional array called a matrix. See program four.

GRAPHICS

On the Atari, information can be displayed graphically or using text in a number of different ways according to the number of colours required and the amount of memory to be used. The operating system already has a number of 'modes' defined to satisfy the different requirements. These modes are selected using the GRAPHICS command. On the XL range, this command will select one of the sixteen set modes of display available (the 400 and 800 have twelve of these modes). The modes are numbered from 0 to 15.

Most of the modes on the Atari are 'split screen' modes. That means that at the bottom of each mode is a text display. This split screen effect can be removed by adding 16 to the mode number when using the GRAPHICS command eg GRAPHICS 7-16. If you add 32 to the mode number when selecting a mode, then the computer will not clear the screen memory when displaying the new mode. This is good for switching from a screen with a text window (split screen) to one without. Program 5.



COLOR

The COLOR command is used within the drawing modes to select which colour the next point or line will be drawn in. With most modes, drawing with COLOR 0 will draw a line the same colour as the background. Use of the COLOR command is shown in program 5.

DRAWTO

The DRAWTO command is used to draw a line from the last point plotted with the PLOT or DRAWTO command to another specified point. (The command PLOT is described in a later Micropaedia). Before drawing any lines a colour must be selected. If no points have yet been drawn then the line drawn will start from the default value of 0,0. The command looks like this:
DRAWTO x,y, and its use is demonstrated in program 5.

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GOSUB

The GOSUB command is used in conjunction with RETURN to branch a program temporarily away from its normal path. This sort of branching is used mainly where a certain function is to be used more than once. Rather than typing in the lines to perform that function as many times as it needs to be performed, the lines can be put into a subroutine.

When a program gets to a GOSUB command the current location is stored and the jump is executed. At the end of the routine there should be a RETURN statement that will send the program back.

This command is shown in program 2.

GOTO

GOTO is similar to the GOSUB command in that it diverts the execution of a program to another line number. The difference is that this command has no RETURN equivalent. This means that the program will move to the line number specified (see program 2) and will continue from there unless it is diverted again.



CHRS

Within the computer various codes are used for the transmission of characters from place to place. One of these codes is known as ASCII, short for the American Standard Code for Information Interchange. Using this code computers can talk to, and understand each other. The

Atari uses a slight variation on this code called ATASCII (ATARI ASCII). This codes gives a number (0-255) for each character. As an example, the letter 'A' is represented in ATASCII by the number 65. The CHR\$ command generally converts the ATASCII code number to its relevant character. Normally used with the PRINT command the CHR\$ function look like this:

```
PRINT CHR$(65)
```

The above command will print the letter 'A' on the screen. Using CHR\$ you can send control codes and other odd sequences to printers and other machines that could not easily be sent or translated using the PRINT command alone.



ASC

ASC is basically the opposite of CHR\$ and it looks like this:

```
PRINT ASC ("A")
```

This command will produce the ATASCII code for the letter entered between the quotation marks, in this case 65 for the letter 'A'.

CONT

Pressing the BREAK key while a program is running, or if the program encounters a STOP command, will stop the program and produce the message STOPPED AT LINE X

Typing CONT and pressing RETURN at this point will cause the computer to resume execution of the program at the next program line. A program can also be stopped in the middle by the command END. Any statements on the same line as the one where the program was stopped will be ignored when the program resumes at the following line.

Design: Nigel Wingrove
Micropaedia editor: Geof Wheelwright
Contributor: Richard Hawes

NEXT WEEK

We examine the games and business software available for the Atari machines, and we delve further into Atari Basic.

The following week we look at the range of Atari peripherals, including their new line of printers and storage devices.



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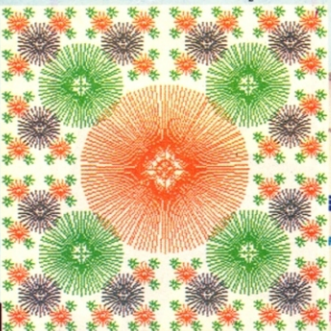
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Dead Language?

David Guest looks at a Cobol implementation for the IBMPC and asks some hard questions.

'Dear Personal Cobol Owner,' Micro Focus' documentation begins, 'the product you have in your hands is the outcome of the most intensive software development project Micro Focus has ever undertaken.'

This is a polite and helpful introduction. Polite, because the reviewer's experience of personally addressed letters is limited to those in hotel rooms that begin 'Dear Guest', which always strikes him as rather brusque. Helpful, because you might have thought the product in your hands is a fossil. It is as well to know the difference.

You may have heard about Cobol. It is the language in which some of the great computer programs were written, much as Greek was the language of Homer.

The really sabre-toothed survivors regard Basic airily as something that a child could master after two hours tuition. They mean this judgement to be dismissive, labelling Basic as a toy that isn't to be taken seriously — but of course they achieve the opposite by drawing attention to Basic's main and overwhelming advantage. Anybody can use it and everybody has. Cobol

has been left behind in the mainframe and minicomputer arena. What Micro Focus intends is not rehabilitation, but as the champion of Cobol on micros it may have to overturn a few prejudices before its protege can be accepted on its merits.

Features

Personal Cobol is not simply a Cobol compiler that runs on a micro. Micro Focus describes it pompously as 'an integrated program development system' which is to say that it is a better means of producing Cobol programs than was available to some of the Neanderthals whose first tongue it was. In addition it has been grafted carefully on to the IBM PC to use the IBM environment very thoughtfully, particularly where the function keys are concerned.

(Incidentally there is no automatic connection between IBM and Cobol, except that both are large, cumbersome, and a brake on progress. IBM has never patronised Cobol exclusively and an IBM programmer is as likely to use mysterious things called RPG II or APL.)

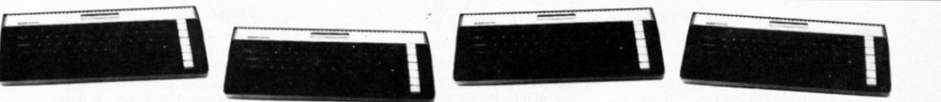
In a nutshell, if you can already find your way around in Cobol, this personalised version will present you with no problems. If you can't you might first of all want to know why you should want to in the first place. Having resolved that question to your satisfaction you'll be pleased to find that Personal Cobol has very few teeth that it will try to cut on you.

It consists of an editor, a code generator and checker, and a run-time system that includes some very useful debugging facilities. There is no compiler — it works at the source code level — and no interpreter in the sense that Basic users will be accustomed to. Micro Focus has split the functions of a compiler by offering, in separate stages, a map and syntax checker, and a form of log production that fixes the references during execution.

The Cobol is extended in certain areas such as colour handling, but if you restrict yourself to the central core of code you can write programs in Personal Cobol on a PC and run them elsewhere, perhaps on an IBM mainframe.

Cobol programming is supposed to be a highly disciplined affair; in theory all you need is paper and a pencil, usually HB or softer so that regular rubbing out doesn't destroy the paper. With forethought and careful planning, the theory goes, you can design and write your program to run perfectly first time without even going near a computer, let alone text editors or debugging utilities. In practice this approach rarely works.

As far as hardware is concerned Personal- 56 ▶



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In the last week of our Atari Micropaedia — Issue 49 — we'll give you the last two of the questions together with a competition entry form. Fill out that form and send it into PCN with your answers clipped from this week's and next week's issue. The first six correct entries drawn will win a micro, the next three will win Atariwriters and the last five will get Donkey Kong games for the micro of their choice.

- 1) What was Atari's first successful video game? _____
- 2) How much RAM memory comes standard with the new Atari 800XL? _____



PCN PRO-TEST SOFTWARE

al Cobol needs 256K of RAM, twin double-sided disks (or one floppy and one hard disk on an XT) and PC DOS 1.1 or 2.0. Micro Focus says it has no intention at the moment of putting the product on to any other micro.

Documentation

Before you unwrap your Personal Cobol you may notice its remarkable weight, which reinforces the view that what you are holding may be a lump of sedimentary rock harbouring the remains of a trilobite.

But once you have it out in the open there is no doubt — this is a piece of software. It is perfectly obvious from the 2in-thick manual. At first there is no sign of software — the disks are tucked away in a wallet at the back, like pressed flowers. Perhaps you are intended to read your way to them.

The plastic-backed ring binder that you extract from the cardboard packaging proves to contain four distinct manuals in addition to the diskettes. On the inside cover there is the pocket guide to Personal Cobol and this is a perfectly adequate notebook that should answer most questions when you've used the heavyweight manuals to get to know the system.

On the rings themselves are the Beginner's Guide, Getting Started, an Operating Guide, and the prodigious Language Reference Manual. When it's possible to run Cobol programs on a micro you'd think somebody would have mastered book production, but apparently not. Ring binders are fashionable and (for the manufacturer, at least) cheap, so we are stuck with them.

There is more evidence of thought-deprivation on the pages themselves. The letters printed there have the tell-tale fuzziness of dot-matrix printer output. M's occupy as much space as I's. In chunks the text is almost unreadable from a distance greater than 18ins. To compound the problem the paper shines unpleasantly.

Why quibble about all this, you may ask? Because in the production of the software Micro Focus has obviously gone to a great deal of trouble to make life as simple for the user as possible. It seems nothing short of stupid that the company should accompany its software with an almost unreadable manual. What is wrong with real print, cheap paper, design, and workable binding?

For content it is difficult to fault the documentation. Getting Started does exactly what it sets out to do — the exercises it covers are not especially ambitious but they take you through the main features.

The Operating Guide is primarily a reference book that lists the help menus offered by the system.

The Language Reference Manual will send shivers of terror up the spine of anybody who has ever tried to learn Cobol from such a volume. It is comprehensive, well ordered, and the underlined words gradually acquire the significance of an incantation.

In use

A Cobol program, like the football league, has four divisions. Personal Cobol in

action can best be considered in four parts (Cobol programmers will recognise the structured approach in this ruse) — program writing, editing, checking and 'animating'.

Writing a program is never something that should be done at a keyboard, say the dogmatic gurus who have made such a mess of applications programming. With Personal Cobol you can write a program without a computer, but to make the most of the package, and particularly its code generation facility Forms, you should interact with the machine from an early stage.

In operation the Cobol systems disk occupies one drive and your work disk the other. The route through Personal Cobol begins at a menu so simple that it is almost unrecognisable as a menu. Thereafter matters become more involved, with main menus, alternative menus, and second



alternative menus all available at the touch of a function key. The Cobol itself allows for as many as 60 nested PERFORM statements — at times it seems that the menus are nested as deeply.

The editor will probably be your first port of call. This is functional rather than spectacular — or perhaps the quality of word processors on micros makes a mere text-editor look old hat these days. Besides, in Cobol the most important feature of an editor is the Tab that makes your listing intelligible. Tabulation is a modest enough feature, but you'd miss it if it wasn't there, whereas life is quite satisfactory even without a global search and replace facility.

Forms appears in the editor's main menu, and this is where you can save much time and even more nervous energy. Code generators are by no means uncommon but to an old Cobol programmer anything that takes some of the leg work out of the Data Division is worth its weight in gold. All that Forms does is produce the code for the screens and forms of your design, and provide for your use of them as the program executes.

Checking the program will be a foreign concept to most Cobol die-hards. The normal procedure is to compile it; if it is respectably large this may take several hours, at the end of which you will know approximately how many errors remain to

be corrected before you'll have something that will run. You take the program away, make corrections, try again, and find that there are still more that the compiler couldn't find.

Checking it with Personal Cobol is more akin to the standard Basic practice. The checker takes the program in line by line, and when it encounters an error it offers you the option of continuing or of returning to the editor to make a change. In the latter case it moves the cursor automatically to the appropriate place for you.

And so to the Animator, to actually run the program. Micro Focus says that it chose this word because a new word was needed — the function of the Animator is so unusual that no existing term is adequate.

The Animator has some quite extraordinary facilities. You can control the speed at which your program runs, right down to one line at a time. You can cut in to look at or change the status of variables. You can watch the program's execution either from the user's point of view or the program's. The documentation takes you through some of the more visually rewarding features in Getting Started and points to the more advanced ones in the Operating Guide. Here the full potential of the Animator becomes clear: for example, it will let you break automatically at an IF, or it will execute a PERFORM paragraph as though stepping over it to avoid wasting time.

As a program development system this amounts to a very creditable package.

Verdict

Beyond this point the review might risk becoming one of Cobol as a language rather than of Micro Focus's Personal Cobol for the IBM PC.

Cobol does have advantages over Basic: it is one language, not many; it was designed (however badly) for business programming; it imposes a structure on the programmer and his output; and it is probably still true to say that there are more Cobol programmers around than any other kind.

Personal Cobol comes from a company with a classy record in Cobol products and it won't tarnish Micro Focus' reputation as far as the technicalities are concerned. The marketing wisdom of putting Cobol on to a PC is another matter — it may be too late to persuade people that Cobol, widely regarded in the mainframe community as a millstone around the neck, should now be taken up by the micro world.

RATING

Features
Documentation
Performance
Usability
Reliability
Overall Value



Now Personal Cobol System IBM PC/XT Price £288 Publisher Micro Focus, 58 Acacia Rd, St John's Wood, London W8 Format Disk Other versions None Outlets Mail order and from IBM outlets.

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Spelling Beeb

Have your BBC edit your typing with a spelling checker.
David Williams reports.

Spell Check is a disk based program which will check your spelling on a BBC-B microcomputer using Wordwise.

The program comes on two disks, one for the main program and the other containing the dictionary. I tested it using a BBC-B with the new AMS 3 inch disk drives.

If you have left it to do the checking unattended you can hear a bleep each time it places a marker, and at the end of the check the computer flashes and beeps until you come back. I found that it takes about 15 minutes to check 3,000 words.

When you run it through again you are offered four options: 'F' which will place the word into the dictionary, 'X' which will place the word into a temporary dictionary — ie if it is the name of a product or person which is only applicable to that particular piece of text, but appears more than once, 'S' which ignores the word and doesn't file it and 'C' which gives you the option to correct the spelling, once corrected the computer then looks at the dictionary to see if it is there, if it is it carries on, if not it leaves you with the previous three options.

Having completed the check you then resave the file back to disc and reload it into Wordwise for printing. The spellchecker automatically ignores any control codes that may be within the text.

letter is allocated a certain number of bytes on the disk, so if, for example, you have filled up the 'B's the computer will then move around on the disk all the 'e's making more space for the letter. This can be a little tedious at first since it does take



Documentation

Beebug provide the disks together with a well laid out, easy to follow instruction manual. The program is also largely menu-driven, making reference back to the manual a rare occurrence.

In use

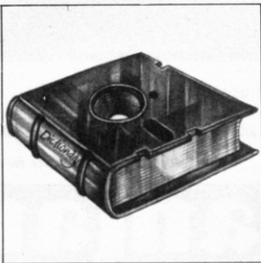
The program is easier to run using two disk drives, but can be worked quite satisfactorily with only one. I found that because the program uses the disk drives a lot and, initially at least, the system has to do a lot of reading the writing, the very much faster 3 inch drives were a boon. Like most Beebug products there is no problem making a backup copy, always a wise move with disks.

Assuming that you have already typed in the text of what you wish to check using Wordwise, you then save it onto a disk. The Spellcheck main program disk is then inserted into a drive, booted up and run. The first menu of options appears on screen and the first thing to do is to nominate the drive(s) that you are going to use for the dictionary and text disks.

Next, using the Load option, you feed the unedited text previously saved back into the computer. Nominating spelling check as an option you then are asked if you wish to be attended or unattended. This means you can either go off and do something else while the computer sorts through the dictionary, marking anything it fails to understand and later coming back to correct items. The other option simply means that you actually do the corrections word by word.

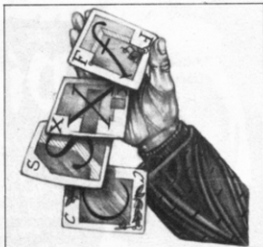
Reliability

The dictionary disk comes with about 6,000 words on it, which at first sight seems perfectly adequate. However, when you start to use the program for the first time it soon becomes clear that the 6,000 words is nowhere like enough, so using the program the first time can be a little time consuming since obviously it fails to



recognise a large number of words, so you have to spend some considerable amount of time adding words to the dictionary. The total capacity of the dictionary disk is only limited by the size of the disk — for the usual 40 track 100K disk this means that you can get about 16,000 words onto it, but if you have 80 track with 200 or 400K the size of the potential dictionary increases proportionally.

The way the dictionary disk is formatted does at first slow down the speed at which words can be added to the dictionary. Each



some time to move everything around, but what it does mean is that all words beginning with a certain letter are grouped together, so that checking is speeded up and later use of the program is much faster.

Since the program is not protected, making a backup copy is no problem, and it's a good idea to make a different dictionary disk for any varying use you make of text. For example, you could make one for dealing with all private correspondence and another which may be to do with a hobby or other activity and one to deal with any business — the options are endless.

Verdict

Being a somewhat enthusiastic rather than accurate typist I found the program to be invaluable, and once I had used it a few times and added to the dictionary, it is fast and reliable. In the New Year, Beebug are planning to release a version which will work with View, but at present anyone who uses the BBC machine as a word processor with Wordwise to any large degree Spell Check is a worthwhile investment.

RATING

Features
Presentation
Performance
User interface
Reliability
Value



Product Spell Check Application Spelling Checker System BBC-B Price £15 (Beebug members) Publisher Beebug, PO Box 109, High Wycombe, Bucks HP11 2TD Format 2 Discs Language Basic/MC Other Versions None at present Outlets Mail Order

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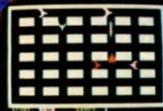
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COMMODORE 64

Laser blazer

Name Mothership System Commodore 64 **Price** £6.95 **Publisher** Softcomm **Distributor** Artic Computing **Tel** 0401 43553 **Format** Cassette **Language** Machine Language **Other versions** None known **Outlet** Mail order and dealers.

This latest import from across the pond takes space games into a new dimension.

Objectives

You are a hero of outer space and it is your mission to combat the hordes of deadly drone ships which the mothership sends hurtling down the Zarway.

The Zarway is an idea pinched from the famous Star Wars picture, when Luke Skywalker has to pilot his ship through a corridor in space and shoot down the enemy ships that are coming in the opposite direction.

With joystick in hand you follow his example. Killing 12 of the enemy drones on the trot takes you onto the next level of play, where strange things are happening aboard the mothership.

In play

After a ten-minute wait while the program loads, the initial screen offers you the choice of a one or two player game, and a skill level.

You are then told the current state of play, before the game proper.

The Zarway is depicted in

glorious technicolour on either side of the screen, and at the top left lies the mothership. You feel distinctly vulnerable as wave after wave of enemy ships are sent towards you.

These are much more manoeuvrable than you and many lives are lost before you get the knack of lining them up in the sights and destroying them as soon as they appear.

Get 12 in a row, and you get taken onto the next screen, which is a very different affair. Here you control a little man, who has to leap about the screen catching elevators and vapourising aliens, which appear from all directions and chase assiduously after you.

Reach the top of the screen and you are on to level three. By this time I had a severe case of 'joystick wrist' and the delights or otherwise of level three will have to remain untold.

The first screen becomes easy after a few plays, whichever skill level you've chosen. The second screen is slower, but harder to master. The final screen is fast, very fast; there's a lot going on and I found it virtually impossible.

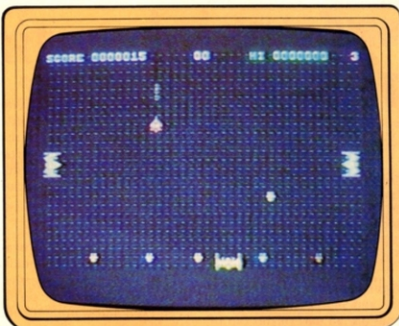
Verdict

This is a fast and furious game, that takes some getting used to. Splendid use of graphics and sound, and a responsive joystick all add up to a superb piece of arcade action.

Pete Gerrard

RATING

Lasting appeal	★★★★
Playability	★★★★
Use of machine	★★★★
Value for money	★★★★



Way of a warrior

Name Quintic Warrior System Commodore 64 **Price** £6.95 **Publisher** Quicksilver, Southampton **SO1 1LL** **Format** Cassette **Language** Machine code **Other versions** None **Outlets** Retail/Mail order.

If you're a Gridrunner fan this game is for you. It is one of the better ones of a fast-expanding clan.

Objectives

You must defend a grid from a host of mutant invaders. Fortunately, the majority of these do not fire at you. However, in order to keep life more interesting and difficult, there are three laser bases which should be helping you but have gone wild, and are now taking shots at you!

In play

You control the hero — 'Superman the Quintic Warrior' who stands alone against the sinister Crabmen and Mangled Mutants. And a pretty vicious bunch they are.

Initially you can choose your level of difficulty. You appear in the middle of the grid and the laser bases make an immediate bee-line for you. All three must hit you simultaneously to kill you, which they attempt relentlessly.

To destroy the mutant invaders you shoot them with your blaster or crash into them with the Quintic Warrior. Be warned — you lose one-tenth of a life each strike with the latter method which seems generous for such suicidal tactics.

The laser bases are annoying: you cannot, at any time, stay

still or they will home in on you. After your destruction, when you reappear in exactly the same spot, the laser bases are still there waiting for you and unless you have your joystick set to move before your reincarnation you'll get shot at over and over again.

At the higher levels of difficulty various new hazards appear on the grid. Zed bolts are the first and they are pretty lethal if you are not deft enough with the joystick.

Another mutant, this time a worm, appears at a later stage and is extremely difficult either to avoid or to destroy.

The game ends if you lose all your lives or one of the invading mutants reaches the top of the grid.

For help you are supposed to use your 'Quintic Factor'. This is your sixth sense but I seem to be sadly lacking anything like that; I found it hard enough to survive at the lower levels and only occasionally made the higher grades.

Verdict

This Gridrunner-style game is quite good and the sound has been used reasonably effectively. The game is very fast and tricky and should keep even the most hardened player busy for a long time.

If you don't have a game of this ilk already you should consider this one as an addition to your software library.

Nigel Farrier

RATING

Playability	★★★★
Use of machine	★★★★
Value for money	★★★★
Overall value	★★★★





The last game, 3D Link, is exceptionally good. Similar to the familiar noughts and crosses idea, here you're presented with four 3 by 3 grids and your task is to get four in a row before the Orc manages to outwit you.

In Play

First up is Hangman. Fairly simple graphics are involved, but the look on the face of the figure dangling from the gallows is really quite a treat. One minor snag is that after each letter is guessed correctly, you are invited to have a stab at the whole word before continuing, even if you've only got one letter out of seven.

The second game, Moonlander, is another classic of its kind which makes use of simple and colourful graphics alongside loud sound effects.

The last title is one to settle Substrike.

Earplugs might also be well employed on Road Race and the hidden word puts your neck in a noose. Whisking you deep into a hidden word puts your neck in a noose. Whisking you deep into a hidden word puts your neck in a noose. Whisking you deep into a hidden word puts your neck in a noose.

Verdict

If you want a package guaranteed to contain some old favourites, this is for you. Overall, nothing very original, but these games have been enjoyed on computers since their first beginnings.

Sue Denham

RATING
Lasting appeal
Playability
Use of machine
Value for money

Noight to Noose

Name Multi games 2 **System** Orc
ASK Price £6.95 **Publisher** Tansor Ltd, Units 1 and 2, The Techno Park, 645 Newmarket Road, Cambridge
Outlets Mail order
Format Cassette and machine code
None

If this games tape had been around five years ago, it would have knocked the socks off everything else on the market. However, times change and sophistication is the new watchword — so is there room for a word — in this case, very profane? Well, in this case, very profane? Well, in this case, very profane? Well, in this case, very profane?

First Impressions

Five titles are included — Hangman, Moonlander, Road Race, Substrike and 3D Link — and all are recorded at slow speed only, so you have to wait around for the action.

Replacing your space gear with goggles, Road Race gets you out on the race track. And if that's not your bag, you could always try your hand at lunar thing depth charges at enemy submarines in Substrike.

ORIC Turned Turtle

First Impressions

The picture on the cassette insert is appealing but has little to do with the picture on the screen. It shows a green turtle wearing a red and yellow hoar with a Manchester United quart round his neck.

In play

The game begins with a screen, and right in the middle is a patch of 12 red strawberries. At the bottom lurks the turtle. As the bottom lurks the turtle, suddenly, all hell breaks loose. The bugs start their descent from the top of the screen, manically rushing around in bewilderingly haphazard fashion.

Control is with the keyboard or with a joystick, and, as usual, is much easier if the additional hardware is available. Nevertheless, practice pays off in the end, but it's unfortunate that the Orc's cursor control keys are arranged in such an illogical order, as four fingers are needed to control the turtles movement, and fifth digit to hit guns.

Verdict

Overall, a pleasing game, though limited by its simplicity. It makes good use of the Orc's sound capability, and it's fast, though not too difficult to master.

RATING
Lasting appeal
Playability
Use of machine
Overall value

A gun-slinging turtle, strawberries and an assortment of giant bugs are all part of this out of season arcade game.

Objectives

The scenario is quite simple. Our armoured reptile is getting thoroughly fed up with the army of bugs intent on murdering their way through this year's bumper crop of strawberries. In a moment of sheer desperation he acquires a couple of six-shooters and attempts to halt their antics once and for all.

Caution is the name of the game, because not all the bugs are hard-line strawberry addicts. Some are interested only in being spectators. However, should one of this variety be accidentally attracted, they immediately become average their friend.

The other two varieties are far less reasonable, and seem to work in harmony as they systematically progress towards a successful mission.

While the greedy strawberry dealers nibble their stomachs full, along comes a wave of back-up bugs to distract your attention.



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The Apple is well served for adventures. Cliff and Denise McKnight look at what's available.

Apples in distant lands

On cold winter nights we used to stoke up the fire and settle down with the crossword. Then we got the Apple, and things have never been the same since. We did quite a lot of 'work' and played a fair few arcade games, but the things which really ate into the evenings were adventure games. You know, GET ROCK, KISS FROG and all that kind of thing.

The table below is an attempt to give some guidance on the Apple adventure market. It represents some of the games we've battled our way through (and some we're still battling with) so that you can get an idea of what is available. The list is by no means complete — fortunately there are quite a few we haven't tackled yet so we've got plenty to look forward to.

If you're a complete beginner and have never played an adventure game before you should probably ignore the table for now and start with something like **Birth of the Phoenix** from Phoenix Software. The manual explains the basic adventuring activities and the disk contains a text-only adventure game which you should find manageable. In terms of the scale of difficulty used in the table it rates a 1.

Older adventures (like **Wizard and Princess**) tended to occupy a single side of disk, but increasingly today's games are double-sided. Of course, **Time Zone** with its six double-sided disks is an exception, and it's priced accordingly. The prices given in the table are approximate, and you may be able to get the games for less if you put in some effort shopping around.

Of course, the advantage with disk-based adventures is that plenty of hi-res screens can be held on the disk. This means that the modern game is likely to be of the hi-res type, with four lines of text below each picture. It's a bit surprising, therefore, that one of the most popular Apple adventure games is text-only. The **Zork** trilogy is so popular that it has an independent 'user-group' that publishes maps, hint sheets, bumper stickers and a variety of other items.

Escape from Rungistan also breaks with convention in that the graphics are line-drawings rather than pictures. However, it compensates by making more than average use of sound and

animation. Similarly, **The Prisoner** doesn't have the usual style of graphics, but the game is certainly demanding. Incidentally, if you've played **Prisoner I** you won't find enough new in **Prisoner II** to merit another purchase.

If you've seen **The Prisoner TV** series and liked it, the adventure game is worthy of the name. It certainly makes a change from the dragons and magic swords variety. There are a few other different scenarios around too. **Transylvania** is a **Hammer Horror** game, **Sherwood Forest** is what you'd expect from the title, but **Adventures in Flesh** is not quite what you might expect.

Far from being a rival to the classic **Soft Porn Adventure** (which is what you'd expect), **Adventures in Flesh** follows the **Fantastic Voyage** approach whereby you're in a micro-sub journeying through the human body. It has the added distinction of being medically accurate, and comes supplied with a human anatomy colouring book instead of maps.

Another difference with **Adventures in Flesh** is that the 'solution' changes with each

game. You have to diagnose eleven conditions which are randomly selected from a larger set. Practically all the other games have a single solution, although **The Quest** has more than one route to the solution. Most adventure games get swopped (or sold in PCN Bill-board) once completed.

The **Spodge Factor** is not something you'll find in any other description of adventure games. It's our attempt to capture the overall 'feel' of the games and is made up of several dimensions, some of which are hard to describe.

For example, some games have a distinct 'linear' feel to them. You are basically moving forward, and if you don't solve a particular problem you can't get any further. Some improve on this by being large enough for you to explore several bits, but you usually have to put the pieces together in a particular order. Linear games tend to have a low spodge factor.

Spodge is also correlated with what you might call command sophistication. With some games, you have to get the phrase exactly right — 'get rock' works but 'take rock'

doesn't — and anything else is met with 'I don't understand' or an equivalent. At the high end of the scale, some games have an almost uncanny intelligent feel and will keep you chatting merrily.

There is also a tendency for spodge to be correlated with difficulty, but it's not a perfect correlation by any means — see for example the games with difficulty score of 4. Even low difficulty and low spodge doesn't necessarily mean a poor game, as **Sherwood Forest** demonstrates. It's a thoroughly enjoyable game and would be fun for the novice.

Some of the games, like **Transylvania** and **Sherwood Forest**, are overtly humorous, while others express their humour in the form of sarcastic comments on unusual actions. Indeed, one of the fun things to do with an adventure game is to see what sort of inputs have been anticipated — what happens if you use profanities, for example.

We've had good fun with all these games and it would be impossible to single out a favourite. There's bound to be a hit-and-miss element when you choose an adventure game — you might get hopelessly stuck and hate it or skate through it and hate it — but if you like puzzles then gird up your loins, sally forth and good luck!

Adventure	Publisher	Price (inc. VAT)	Disk sides	Graphics on T[ext]	Scenario	Difficulty (1-5)	Spodge factor (1-7)
Time Zone	Sierra On-line	£65	12	G	History + Sci-fi	4	5
Dark Crystal	Sierra On-line	£30	4	G	Fantasy	3	3
Transylvania	Penguin	£19	1	G	Hammer 'Horror'	2	4
The Quest	Penguin	£20	2	G	Fantasy	3	6
Blade of Blackpoole	Sirius	£30	2	G	Fantasy	4	3
Escape from Rungistan	Sirius	£23	1	G	Contemp. escape	2	3
Kabul Spy	Sirius	£26	2	G	Contemp. spy	4	4
The Prisoner I/II	Eduware	£25 each	1	G	Surreal escape	4	7
Zork I/II/III	Infocom	£31 each	1	T	Fantasy	5	7
Adventures in Flesh	Krell	£34	1	T	Medical	2	4
Sherwood Forest	Phoenix	£25	1	G	Robin Hood	2	2

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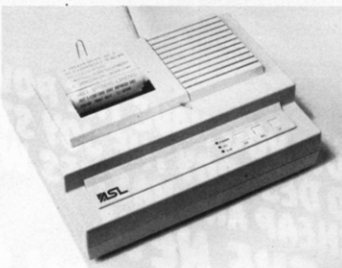
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Mike Gerrard and his Sinclair go adventuring with a bagfull of games.



Specifically Spectrum

Arcade games and adventures still dominate the Spectrum software market, and this round-up reflects that by looking at two arcade games, two adventures, and an adventure that includes three arcade-style games.

I'M IN SHOCK



This simple but addictive zapping game fills the screen with a 31 x 23 grid,

and you patrol the bottom firing at the vicious creatures that are buzzing above, bent on your destruction. This may sound like Gridrunner, but the difference is that some of the columns contain deflecting plates that turn your shot through 90°, and if you can't fire directly at the aliens you can use these plates to bounce your shots round a few angles, like an intergalactic Alex Higgins. This is no mean feat as the creatures move quickly. Control, is by the keyboard and the most important feature is the high-score record, because that's what you'll always be aiming to beat. The graphics don't need to be anything special as the action is fast and the sound relentless.

TUTANKHAMUN



When you tire of killing aliens move on to Mummies from ancient Egypt, which, along with skulls, spiders, snakes and indefinable monsters, are the hazards out to get you in five mazes. Using Kempston or AGF joysticks, or the sensible keyboard lay-out, you manoeuvre along the underground tunnels, and collecting goodies and shooting baddies along the way, you search for the key that will open the door to the next level. The screen scrolls automatically, and a scanner shows the whole of the that particular maze at the top of the screen. The machine code movement is fast, and while it obviously owes a lot to several other berserk-style games that are around, it is well done and extremely difficult to master.



CASTLE COLDITZ



To escape from Castle Colditz you must make your way from the prisoners' room to the castle's main gate, and this could be described as the archetypal text-only adventure. You move using N, S, E, W, U, O, R, D; C lets you know what you're carrying (up to six) items; L re-describes your location if the text has scrolled off the screen; the optional instructions advise you to make a map and warn that some exits are one-way only; there's a Save option; you're given a list of verbs you can use in the verb-noun commands, these include take, leave, use, fight and soon; you'll find objects such as a rope, torch, pencil, chisel; and finally there are Nazi treasures you can try to smuggle out.

Though in machine language and quick to respond, the adventure is traditional and reliable — even the surprises were unsurprising as I moved round the Gun Room, or the Blanket Store, trying to escape. I was just waiting to find myself in a room with no apparent means of escape, and eventually it turned up, the Wine Cellar where all you can see is a barred window which proves very difficult to break open.

The game is perfectly well done and thorough, but lacks sparkle and imagination, as if it were the latest to fall off the adventure production line.

THE CROWN



The Crown was put out originally on the 16K ZX-81, but it's hard to see where that extra memory has been used up since the whole adventure has rather an amateurish look.

It is set in the mists of time when everyone had funny names: 'After the fall of the House of Rof and the theft of the ancient sceptre by the Orckind, Invi the Elder took the great Crown of Rof . . . ' Your task is to recover the crown and ensure that once again good triumphs over evil.

The scene descriptions will hardly win any literary prizes: 'Fork in road, Exits: N, W, E, you see: (followed by a blank). Unfortunately 'You see: appears even when there's nothing there, which looks a bit odd on the screen, as do some of the responses. In one location I could see an axe. 'Take Axe,' I said. 'What?' it replied. 'Take Axe,' I repeated. 'What? Take Axe,' I insisted, there being an axe staring us both in the face. 'You carry the Axe,' it finally agreed, and in other places too some perfectly acceptable commands were greeted by the uncomprehending 'What?'

This adventure doesn't have a lot going for it, cheap though it is, and as far as I'm concerned evil can triumph over good if it means I don't have to play again.

MAD MARTHA II



The adventure/arcade bridge is provided by the follow-up to the very successful Mad Martha, which the cassette cover claims contains 'three exciting arcade-type games.' I would take that 'exciting' with a generous pinch of salt. The hen-pecked Henry, ie you, is on holiday in Spain with Martha and son Arbutnoot, who have both gone off on a coach trip leaving you sitting in the sunshine enjoying a cool drink. Waiter Manuel, who also happens to be Martha's cousin, brings you a letter doused in perfume, and off you set on your travels around the town to find out what's going on. After all, you can't read the letter till you find your spectacles, and you can't get out of the dark alley without something to light the way, and what does the bullfight poster mean, and when will that phrasebook come in handy?

The graphics are rather limited, the speed of response is slow, and there was also the occasional unusual reaction from the program. On the beach I tried the command 'Dig,' only to be confused by the reply 'You must wear your spectacles'. What can this mean?

There are three skill levels, and this is a race against the clock — once you've found your time-piece, of course. The program allows for multiple command entries, and can be saved. Although I didn't feel it was testing my powers of deduction to the full, it still has a certain appeal and is definitely different, which is all to the good when there's so much mediocrity about.

I'm In Shock (16K, £4.95), Artic Computing Ltd, Main Street, Brandesburton, Driffield YO25 8RL.

Tutankhamun (48K, £5.95), Micromania, 14 Lower Hill Road, Epsom, Surrey KT19 8LT.

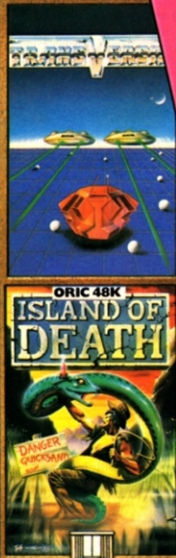
Castle Colditz (48K, £5.95), Felix Software, 19, Leighton Avenue Pinner, Middx HA5 3BW.

The Crown, (48K, £4 mail order, £4.60 retail, also available for 16K ZX-81 and Lynx), Symbol Software, PO Box 181, Chester CH1 3XT.

Mad Martha II (48K, £6.95), Mikro-Gen, 1 Devonshire Cottages, London Road, Bracknell, Berkshire RG12 2TQ.

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POT HOLE

Lunar Lander is an old, old game that comes on micros ancient and modern. Well here it is again, but before you start groaning, this version is almost completely unrecognisable from the original as it has been revamped and upgraded to the form printed here.

Nicholas Hewitt of Ayrshire, Scotland, has used the graphics capabilities of the Dragon 32 to good effect and produced a game not as easy to finish as might appear at first sight.

You take the part of Captain Pilot of The Fleet of six ships. You are responsible for landing your fleet without pranging any, well not too many, of your ships. Steering is done either with the keyboard, using the right and left arrow keys, or by the judicious use of a joystick. Control over the amount of thrust coming out of the back of the ship is by use of the up arrow key or by

Title: *Pot Hole*
Machine: *Dragon 32*
Language: *Basic*
Application: *Game*
Author: *Nicholas Hewitt*



pushing the joystick forward.

The game originally used the speed up POKE, in line 40, this was 40 POKE &HFFD7.0. Unfortunately the PCN Dragon is one of the permanently slow kind and this POKE just crashed the machine, so line 40 was removed.

If your machine will go fast, put the POKE back into the program, otherwise either play the game a little more slowly

or increase the amounts added and subtracted from X in lines 1480, 1500, 1590 and 1600, increase the value of V in line 250 and the amount subtracted from D in lines 1520, 1620.

Finally, when the game is first run, the high-resolution screen will be full of rubbish. To make the game run properly just follow the prompts; i.e. press a key to play the game.

Program notes . . .

- 40 Put speed up POKE in line 40 if applicable. Note this won't work on some Dragons.
- 60 Reserve space for strings and set the top of the memory pointer.
- 70 Set up variables and dimension arrays.
- 80-110 Clear the screen and print option. Get, and act on, the response.
- 120-160 Print message about joysticks and wait for a key to be pressed.
- 170-240 Read and POKE the machine code data into the memory from &H7000.
- 250-260 Set up some variables and clear the screen.
- 270 Gosub and print the instructions.
- 280 Clear the high-resolution screen to background colour 2.

```

10 REM *** BY N.D.HEWITT ***
20 REM *** (C) 3/12/83 ***
30 PCLS
50 REM ** SPEEDS COMPUTER UP **
60 CLEAR1000,&H7000
70 M=0:SH=2:DIMA(8,8):DIMAA(8,8):DIMAB(8,8)
80 CLS:PRINT@224,"DO YOU WISH TO USE A JOYSTICK?"
90 YY$=INKEY$:IFYY$="" THEN 90
100 IF YY$="Y" THEN 160
110 IF YY$(">")="N" THEN 90
120 PRINT:PRINT"PLEASE DISCONNECT ANY JOYSTICKS"
130 PRINT"AS THESE AFFECT MOVEMENT, AND"
140 PRINT"THEN PRESS A KEY."
150 IF INKEY$="" THEN 150
160 I$=INKEY$
170 I=&H7000
180 I=I+1
190 READ A$
200 IFA$="Z"THEN250ELSEPOKEI,VAL("&H"+A$):GOTO190
210 REM**POKES DATA FOR MACHINE
220 REM @CODE FOR KEY MOVEMENT**
230 DATA C,00,00,7F,70,FF,F7,FF,02,F6,FF,00
240 DATA 34,04,A1,E0,26,03,73,70,FF,39,Z
250 L=0:X=128:Y=10:D=1:V=3
260 CLS
270 GOSUB 1720
280 PCLS2
290 DRAW"BM3,0;S4;R3D1R1L5D1L1R2D1L1R5U1R1L2D2L3"
300 DRAW"D1L1D1L1D1R1U2R1U1R3D1R1D1R1D1L1"
310 FOR Z=1 TO 22

```



POT HOLE

- 290-420 Draw the spacecraft, the bust spacecraft and the equivalent background square and copy them into the appropriate arrays for later use.
- 430 Clear the screen back to colour 2.
- 440 Select a random playing screen (and check that it's not the previous one.)
- 450 Put the present screen number into RS.
- 460-470 Jump the appropriate screen drawing routine.
- 480-760 Draw screen 0.

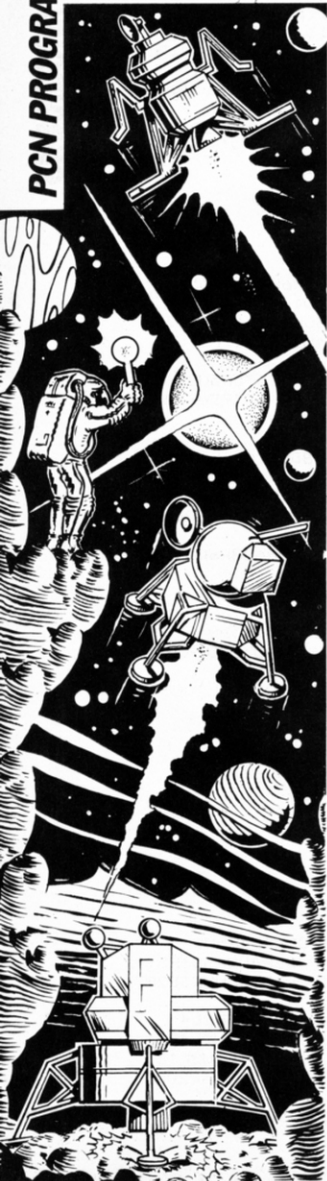
```

320 READ J,K,H
330 PSET (J,K,H)
340 NEXT Z
350 DATA 10,10,4,17,10,4,11,11,4,16,11,4
360 DATA 12,12,4,15,13,4,13,13,3,14,13,3
370 DATA 15,13,3,16,13,3,17,13,3,10,14,3
380 DATA 11,14,3,12,14,3,13,14,3,14,14,3
390 DATA 12,15,4,15,15,4,11,16,4,16,16,4
400 DATA 10,17,4,17,17,4
410 GET (0,0)-(8,8),A,G:GET (20,20)-(28,28),AA,G
420 GET (10,10)-(18,18),AB,G
430 PCLS2
440 SR=RND(3):IF SR=RS THEN 440
450 RS=SR
460 IF SR=1 THEN 770
470 IF SR=2 THEN 1090
480 DRAW"BMO,72;S4;R6D9R3U3R6U7R10D5"
490 DRAW"R5D10R6D20R4D30L5D10L6D7L3D2"
500 DRAW"L6D10R25D3L25U3R30U7R3D15R20D3"
510 DRAW"L15U3R15U20L5U7R4U12L8U12R17U5L10U15"
520 DRAW "L10U5R4U3L2U7R8U9R11D3DR5U8R6"
530 DRAW"R5U6R2D3R4U2D5R6D3U2R2D4R5U6R4"
540 DRAW"R4D12L7D3R2D4L8D6R2D4L4D6"
550 DRAW"D7L5D4L5D6L2D4L5D12"
560 DRAW "R20D3L20U3R23D7L8D9R20D3L20U3R20"
570 DRAW"U2R5U7R8U9L3U6L5U6R3U5L2U7"
580 DRAW "L2U6R7U4R3U7R2U4R6U8L3U5U8R6U4"
590 DRAW"R5D7R8U4R6D3L2D5R9U5R6U8R6U4R5U7R3U9"
600 DRAW"R15D6R2D7L8D4L6D2L2D3L2D5"
610 DRAW"D5L2D6L1D3L4D9L6D3L4D3L7"
620 DRAW"D1L6D2L5D2L2D9R2D5R2D7R3D9"
630 DRAW"R20D3L20U3R20U4L3U7L2U5L2U2R2U2R5U2R6U1"
640 DRAW"R5D6R4D3R6D8R3D7R2D5R20D3L20U3"
650 DRAW"R20U8R3U6L3U5L2U7L4"
660 DRAW"L3U6L4U9R6U4R5U8R2U7"
670 DRAW"U4L3U8L2U9R4U6R8D5R6U4R9"
680 DRAW"U7R7U4R5U2R4U3R6"
690 PAINT (255,192),7,8
700 PAINT (32,166),1,8
710 PAINT (62,175),1,8
720 PAINT (98,142),1,8
730 PAINT (115,158),1,8
740 PAINT (174,139),1,8
750 PAINT (218,145),1,8
760 GOTO 1310
770 DRAW"BMO,30;R4D2R4U3R6D5R3D4R5U2"
780 DRAW"R4U3R3D2R4U3R6D4R4D3R4U2R5D3R5"
790 DRAW"R3D1R4D2U4R3D4R3D2R3D1R5U2R3D2R3U2"
800 DRAW"R3U4R5D3R4U2R3D4R2D3R3D4R2D4"
810 DRAW"D7R2D3L4U1L2D2L5D2L4U2L3U2L4D2"
820 DRAW"L10U2L7D1L9U3L10D2L12D1L3U2L13"
830 DRAW"D20R1D3L2D15R2D3R20D3L20U3R20U2R3U4"
840 DRAW"U4R3U7R2U1R3U3R2D4R8D3R7D2R3U8"

```



770-1080 Draw screen 1.
1090-1300 Draw screen 2.



POT HOLE

```

850 DRAW"R4D9R1D5R2D10R3D4L1D2L6D2L9D4"
860 DRAW"L10D4L8D3L2D8R1D4L2D7R2D9"
870 DRAW"R20D3L20U3R20U4R4U7R8D2R6U6R10U
5"
880 DRAW"R3U6R4U7R3D5R2D9R4D3L4D2L6D9"
890 DRAW"D9L4D6R3D5R20D3L20U3R20U3L2U7L2
"
900 DRAW"U3R4U2R6U4R6U7R3U9R3U5R3U9R3U4L
3UB"
910 DRAW"R5D2R8D3R5D9R3D10R4D6L4D9L5D10"
920 DRAW"L8D7R3D6R20D3L20U3R20U2R7D2R8U9
"
930 DRAW"R3UBR5D5R20D3L20U3R20U7R4U8L7U7
"
940 DRAW"L4U4L3U6L6U4L4U5L5U4L6U8"
950 DRAW"U6L6U4L6U2L9U7L3U5R4U4R6"
960 DRAW"R5D3R8D4R5D3R7D6R3D6R8D5R6D9"
970 DRAW"R20D3L20U3R20U19L3U8L4U9L3U8L3"
980 DRAW"L4U5L3U5L2U4L6U3L8U2L7D3L6"
990 DRAW"L6U3L9D3L5D4L9D3L6UBR4U7R6U5R8U
7"
1000 DRAW"R9U3R17D5R9U2R9D4R10U4R5U4R9D6
R19U7R13"
1010 PAINT (255, 192), 7, 8
1020 PAINT (30, 106), 1, 8
1030 PAINT (54, 157), 1, 8
1040 PAINT (106, 173), 1, 8
1050 PAINT (162, 173), 1, 8
1060 PAINT (200, 161), 1, 8
1070 PAINT (220, 117), 1, 8
1080 GOTO 1310
1090 DRAW"BM 0, 25; R8D3R9D3R8D7R7D5R9D10"
1100 DRAW"R7D3R6D4R3D10R3D9L6D10L4D9L3D1
0"
1110 DRAW"L5D8R4D9R7D6R9D8R6D9L4D3R12U6R
11D8"
1120 DRAW"R5D9R20D3L20U3R20U7R9U6R12D10"
1130 DRAW"R7U9R3U10R12D6R3D9R20D3L20U3R2
0"
1140 DRAW"U6R9D12R4D2R5D10R20D3L20U3R20U
7RBU20R15"
1150 DRAW"U10L5U19L8U20R4U19L6U16L4U17"
1160 DRAW"L12D5L18D6L12D4L17D6L20D7L22"
1170 DRAW"D10L16D16R4D8R20D3L20U3R20U7R1
2D3"
1180 DRAW"R8U10R4D7R20D3L20U3R20U6R9U5R1
0"
1190 DRAW"D9R20D3L20U3R20UBR5D20L6D8R6D1
0"
1200 DRAW"L12U4L19U6L16D4L18D3L19D5L18U6
L13"
1210 DRAW"U5L14U7L14U9L3U6R3U7R5U8R3U8R2
U9R4U4"
1220 DRAW"R7U3R10U2R17U4R19U8R5U9R10U5R1
4"
1230 DRAW"R5D2R13U3R12D4R15U2R18D3R12U2R
10U4R12"
1240 PAINT (255, 192), 7, 8
1250 PAINT (98, 164), 1, 8
1260 PAINT (164, 156), 1, 8
    
```



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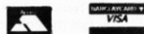
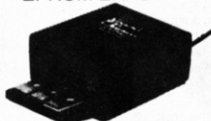
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POT HOLE

- 1310-1320 Prompt to begin the game.
- 1330 Select screen mode, graphics and colours.
- 1340 Check for hitting a rock.
- 1350 Get the colours of the positions of the landing feet of the space craft.
- 1360 Check that they are both on the pad.
- 1370 Check whether the craft has returned to the top left hand corner after landing six craft and if so restart the game.
- 1380 If joysticks were selected, jump to the routine that deals with them.
- 1420-1440 If the up arrow key has been pressed then alter the upward velocity.
- 1450 Rub out the space craft and alter the vertical position by the distance value D.
- 1460-1480 Check the left arrow key and if pressed, update the horizontal position.
- 1490-1500 Do the same for the right arrow key.
- 1510 Print the space craft at the new position.
- 1520 Increase the falling velocity to simulate gravity. To make the game a little more exciting, increase the amount added to D. The maximum downward speed is 30.
- 1530 Continue the game.
- 1560 Read the vertical position of the joystick and update the velocity accordingly. Same as line 1450.
- 1570 Stop the spacecraft from going off the screen. Same as lines 1470-1480 but for the joystick.
- 1600 Same as lines 1490-1500 but for the joystick.
- 1610 Print the spacecraft at the new position.
- 1620 Update the velocity as in 1520.
- 1630 Continue the game.
- 1640-1710 Print the score and prompt for another game.

```

1270 PAINT (202, 174), 1, 8
1280 PAINT (196, 99), 1, 8
1290 PAINT (156, 101), 1, 8
1300 PAINT (112, 108), 1, 8
1310 PRINT "PRESS A KEY TO START";
1320 IF INKEY$="" THEN 1320
1330 PMODE$=SCREEN1,0
1340 IFFPOINT (X-1, Y)=3ORPPPOINT (X+9, Y)=3O
RPPPOINT (X, Y+9)=3ORPPPOINT (X+8, Y+9)=3THE
G OSUB 1960
1350 Z1=PPPOINT (X, Y+9): Z2=PPPOINT (X+8, Y+10
)
1360 IF Z1=1 AND Z2=1 THEN GOSUB 1890
1370 IF X=6 AND Y=10 AND L=6 THEN RESTOR
E: M=M+6: GOTO 160
1380 IF YY$="Y" THEN 1540
1390 REM**READS KEYS DEPRESSED
1400 REM + CHECK FOR STRAYING
1410 REM OFF SCREEN **
1420 POKE&H7002, &HDF
1430 POKE&H7003, &HF7: EXEC&H7001
1440 IF PEEK (&H70FF) THEN D=D-V
1450 PUT (X, Y)-(X+8, Y+8), AA, PSET: Y=Y+(D*.
1)
1460 IF Y<10 THEN Y=10
1470 POKE&H7003, &HDF: EXEC&H7001
1480 IF PEEK (&H70FF) AND X>7 THEN X=X-2
1490 POKE&H7003, &HBF: EXEC&H7001
1500 IF PEEK (&H70FF) AND X<245 THEN X=X+
2
1510 PUT (X, Y)-(X+8, Y+8), A, PSET
1520 D=D+1: IF D>30 THEN D=30
1530 GOTO 1340
1540 REM**READS JOYSTICK + CHECK
1550 REM FOR STRAYING OF SCREEN
1560 IF JOYSTK(1)<20 THEN D=D-V
1570 PUT (X, Y)-(X+8, Y+8), AA, PSET: Y=Y+(D*.
1)
1580 IF Y<10 THEN Y=10
1590 IF JOYSTK(0)<20 AND X>7 THEN X=X-2
1600 IF JOYSTK(0)>44 AND X<245 THEN X=X+
2
1610 PUT (X, Y)-(X+8, Y+8), A, PSET
1620 D=D+1: IF D>30 THEN D=30
1630 GOTO 1340
1640 CLS: PRINT "YOU LANDED "; M+L; " TIMES
BEFORE"
1650 PRINT " YOU LOST YOUR FLEET"
1660 PRINT " ANOTHER GAME ?"
1670 II$=INKEY$: IF II$="" THEN 1670
1680 IF II$="Y" THEN RUN
1690 IF II$="N" THEN POKE65494, 0: CLS: END
1700 REM **SLOWS COMPUTER DOWN**
1710 GOTO 1670
1720 CLS
1730 PRINT " POT-HOLES"
1740 PRINT " YOU HAVE 3 LANDING CRAFT WHI
CH"
1750 PRINT "YOU MUST GUIDE DOWN THE HOLES

```





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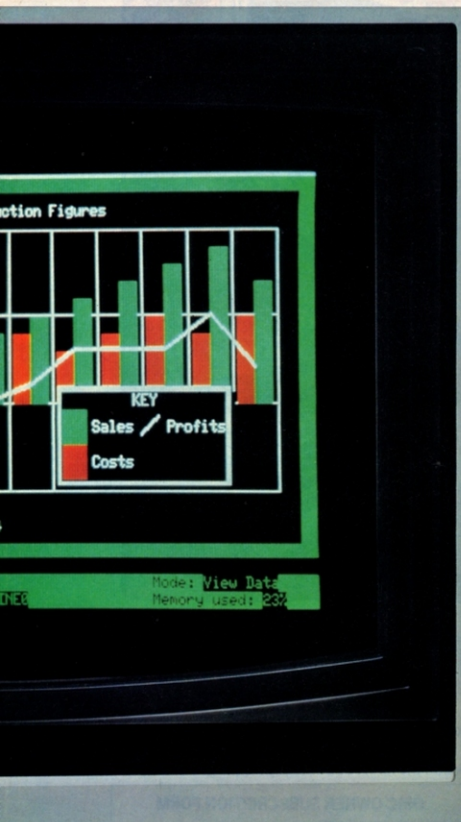
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New-Sinclair QL

There's no comparison chart, b



The Sinclair QL is a new computer.

Not just a new Sinclair computer, but a totally new sort of computer – nothing like it exists anywhere.

It's not just a bit better than this, or a bit cheaper than that – it's a computer that's very hard to compare with anything. Just check the features below – and if you don't agree, take up the challenge at the end of the advertisement.

If you do agree, there's only one course of action you can take... get yourself a Sinclair QL at the earliest possible moment.

The Sinclair QL has 128K RAM. Big deal?

Several micros offer 128K RAM, or more, as standard. The 'What Micro?' table for December 1983 lists over 50 of them – but 40 of the 50 micros listed cost over £2,500!

The Sinclair QL offers you 128K RAM for under £400, and an option to expand to 640K. That's a lot of bytes to the pound!

The Sinclair QL has a 32-bit processor. Who else?

Under £2,700, nobody. Even the new generation of business computers, such as the IBM PC, are only now beginning to use 16-bit processors.

At prices like this, the Motorola 68000 family – widely regarded as the most powerful microprocessors available – will remain a luxury.

Yet with the Sinclair QL, the 32-bit Motorola 68008 is available for less than £400.

You can also be sure that the QL will not become outdated. 32-bit architecture is future-proof.

32-bit processor architecture, 128K RAM, and QDOS combine to give the QL the performance of a mini-computer for the price of a micro.

Exclusive: new QDOS operating system

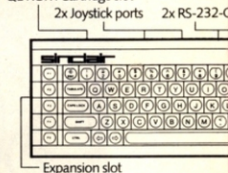
No competition! QDOS sets a new standard in operating systems for the 68000 family of processors, and may well become the industry standard.

QDOS is a single-user, multi-tasking, time-sliced system using Sinclair's new SuperBASIC as a command language.

One of its most significant features is its very powerful multi-tasking capability – the ability to run several programs individually and simultaneously. It can also display the results simultaneously in different portions of the screen. These are features not normally available on computers costing less than £7,000.

Eleven input/output ports

QL ROM Cartridge slot



New professional keyboard

The QL keyboard is designed for fast input of data and programs.

It is a full-size QWERTY keyboard, with 65 keys, including a space bar; left- and right-hand shift keys; five function keys; and four separate cursor-control keys – key action is positive and precise.

A membrane beneath the keyboard protects the machine from dust (and coffee!), and for users who find an angled keyboard more comfortable, the computer can be raised slightly at the back by small detachable feet.

£399

because there's no comparison!

Advanced new friendly language – Sinclair SuperBASIC

The new Sinclair SuperBASIC combines the familiarity of BASIC with a number of major developments which allow the QL's full power to be exploited.

Unlike conventional BASIC, its procedure facility allows code to be written in clearly-defined blocks; extendability allows new procedures to be added which will work in exactly the same way as the command procedures built into the ROM; and its constant execution speed means that SuperBASIC does not get slower as programs get larger.

Included – superb professional software

The suite of four programs is written by Psion specially for the QL and incorporates many major developments. All programs use full colour, and data is transportable from one to another. (For example, figures can be transferred from spreadsheet to graphics for an instant visual presentation.)

Word-processing

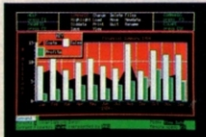


Certain to set a new standard of excellence, QL Quill uses the power of the QL to show on the screen exactly what you key in, and to print out exactly what you see on the screen.

A beginner can be using QL Quill for word-processing within minutes.

QL Quill brings you all the facilities of a very advanced word-processing package.

Business graphics



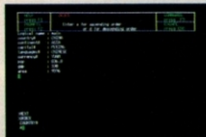
QL Easel is a high-resolution colour program so easy to use you probably won't refer to the manual! It handles anything from lines, shaded curves or histograms to overlapping or stacked bars or pie charts. QL Easel does not require you to format your display before entering data; it handles design and scaling automatically or under your control. Text can be added and altered as simply as data.

Spreadsheet



QL Abacus makes simultaneous calculations and what if model-construction easier than they've ever been. Sample applications are provided, including budget-planning and cash-flow analysis. QL Abacus allows you to refer to rows, columns and cells by names, not just letters and numbers. Function keys can be assigned to change a variable and carry out a complete 'what if' calculation with a single key-stroke.

Database management



QL Archive is a very powerful filing system which sets new standards, using a language even simpler than BASIC. It combines ease of use for simple applications – such as card indices – with huge power as a multi-file data processor.

An easy-to-use labelling facility means that you don't have to ask for your file by its full name – a few letters are enough.

New – the Sinclair QLUB

The QLUB is the QL Users Bureau. Membership is open to all QL owners. For an annual subscription of £35, QLUB members receive one free update to each of the four programs supplied with the QL, and six bi-monthly newsletters. Sinclair has also made exclusive arrangements for QLUB members to obtain software assistance on QL Quill, Abacus, Archive or Easel by writing to Psion.

The Sinclair QL challenge

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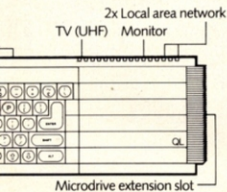
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For more information

Phone Camberley (0276) 686100, or use the coupon to get a QL brochure.

Please allow 28 days from receipt of order. Remember that Sinclair offers a 14-day money-back undertaking.

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Two 100K microdrives built in

The Microdrives for the Sinclair QL are identical in principle to the popular and proven ZX Microdrives, but give increased capacity (at least 100K bytes each) and a faster data-transfer rate. Typical access speed is 3.5 seconds, and loading is at up to 15K bytes per second. The Sinclair QL has two built-in Microdrives. If required, a further six units can be connected.

Four blank cartridges are supplied with the machine.



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THE DUNGEON MASTER

Let your Spectrum be your guide in a totally new dimension in adventures in the true spirit of traditional role playing games where YOU design the scenario.

"I have been a Dungeons and Dragons fan for several years - The package provides excellent entertainment for all fans of the cults and should prove a good introduction to the game."

—Sinclair User.

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—ZX Computing.

ZX Spectrum 48K £7.50

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What the real critics say. . .

Very rarely have software titles produced such universal acclaim as 'Halls of the Things' and 'The Dungeon Master'. Now, with three brand new programs, Crystal continues to set the standard of software excellence. The difference is obvious - the choice is yours:

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A stunning multi-level maze 'arcade - adventure'. "Excellent and dangerously addictive - could change the Spectrum games scene overnight."

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POT HOLE

◀ 74 1720-1880 Print the instructions for playing the game.
 1890 Landing subroutine. Repaint the landing pad and put the spacecraft just above it; update the number of landings.
 1900 Reprint the spacecraft.
 1910 Play the landing tune.
 1920 Rub out the spacecraft.
 1930 Check landing speed and if too great then gosub to the crash routine.
 1940 If speed greater than ten then it was a hard landing.
 1960 Crash subroutine print the crashed spaceship picture onto the screen.
 1970 Play crash tune.
 1980 Rub out the crash picture.
 1990 Reset the position of the spaceship and check the number of ships is greater than zero.

```

1760 PRINT"AND LAND ON THE LUNAR PADS BY
"
1770 PRINT"USING THE LEFT AND RIGHT CURS
OR"
1780 PRINT"KEYS AND THE UP ARROW TO SLOW
"
1790 PRINT"YOUR DESCENT (OR USE JOYSTICK
)."
1800 PRINT" IT IS ESSENTIAL TO LAND SOFT
LY"
1810 PRINT"OR YOUR BOOSTERS OR CRAFT MAY
"
1820 PRINT"BE IRREPARABLY DAMMAGED."
1830 PRINT" WHEN TAKING OFF AFTER LANDIN
G"
1840 PRINT"HOLD DOWN THE THRUST KEY (^)
"
1850 PRINT" RETURN TO TOP LEFT AFTER ALL
6"
1860 PRINT"PADS HAVE BEEN LANDED ON."
1870 PRINT" HAPPY LANDINGS!"
1880 RETURN
1890 PAINT (X+4,Y+10),7,8:Y=Y-4:L=L+1
1900 PUT (X,Y+4)-(X+8,Y+12),A,PSET
1910 PLAY"T15;ABCDEFGFEDCBA"
1920 PUT (X,Y+4)-(X+8,Y+12),AA,PSET
1930 IF D>15 THEN GOSUB 1960
1940 IF D>10 THEN PLAY "T4DC":V=V-1
1950 RETURN
1960 PUT(X,Y)-(X+8,Y+8),AB,PSET
1970 PLAY"T4BB":SH=SH-1:V=3
1980 PUT(X,Y)-(X+8,Y+8),AA,PSET
1990 X=128:Y=10:IF SH<0 THEN 1640
2000 RETURN
    
```



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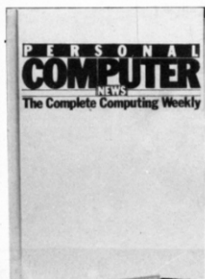
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Issue 1, March 11-18.
Pro-Tests: Apple's Lisa. Tese ZX801. Spectrum speech synthesiser. Apple printer. Commodore network. 3D on Spectrum. graphics package for Apple and IBM. BBC graphics system.

Features: computer chess. Occur parallel processing language. View (Sirius) function keys.
Microcopia: Towers of Braham (Pascal). Biohythm (Amiga II). Home Year (Apple II). Shape Utility (Apple II).

Gameplay: Darts. Soccer (Atari). A Game of Holes (BBC Model B). Pimania (Spectrum). Flight Simulator (IBM PC).

Databases: micro and peripherals.



Issue 2, March 18-25.
Pro-Tests: Toshiba T100. Casio PB100. ZX81/Basicare. Vic speech synthesiser. Spectrum spreadsheet. CAM graphics. BBC word processing.

Features: Colecovision, micro background, names competing. **Gameplay:** Ultima II (Apple). Trader (ZX81). Starquest (Vic 20). Hunt for Horror (Spectrum). **Programs:** String editor (Spectrum). Analogue Clock (BBC Model B). Chart generator (Spectrum). String extract/replace. **Databases:** full software listings.

Issue 3, March 25-April 1.
Pro-Tests: TI Professional. Apple speech synthesiser. Facit 410 printer. IBM keyboards. Pepsico computer printer. Sirus toolkit. Dragoncote. **Features:** Atom upgrade. Lynx programming. Apple music. **Gameplay:** Mangrove (Vic 20). Mutant Herd (Vic 20). Compendium (Dragon). Patience (Spectrum). Noughts and Crosses (Dragon). Great Britain (Edi). **Programs:** Ulysses (IBM PC). **Microcopia:** Magically (Spectrum). Souler (Vic 20). Firing Range (BBC). **Databases:** music.

Microcopia: Anatomy of the BBC, part 3.

Issue 4, April 1-8.
Pro-Tests: Piel Paper Communicator. Olympia ES3000 printer. Namal SuperPrinter. Commodore Calcutest. Spectrum Pascal. Cashbook (BBC). **Gameplay:** Dark Crystal (Apple II). St George (Dragon). Wizard (Dragon). **Programs:** Fruit Machine (C64). Tunematch (Oric). Array Editor. **Databases:** peripherals. **Clubnet:** Clubs and user groups. **Microcopia:** Go Forth, part 1.

Issue 5, April 8-15.
Pro-Tests: Commodore 700. Ikon Hobbit. I-2-3 (IBM). ZX81 machine code. **Features:** speech packs, monitors. **Gameplay:** Grand Prix (Dragon). Derby Day (Spectrum). Deadlines (Apple). **Programs:** Cakes. Wacky Racers (Oric). Fruit Machine (C64). Parsc Interger. **Databases:** software. **Clubnet:** full list of user groups. **Microcopia:** Go Forth, part 2.

Issue 6, April 15-22.
Pro-Tests: Tymic Microframe. IBM PC. Scorpio DKS. Dragon sound module. ZX81 graphics. Bottom Line Strategist (C'PM). PaperClip word processor. **Features:** IBM PC DOS. BBC word processing. PC-121. **Gameplay:** Mined Out (Spectrum). Tropic Island Tower (Spectrum). Lamar Leeper (Apple II). Evolution (Apple II). **Programs:** Wacky Racers (Oric). Mortgage Comparison

(Sharp MZ20K). Computer Set Up (BBC). Day of Week. **Databases:** micro. **Microcopia:** Graphics, part 1.

Issue 7, April 22-29.
Pro-Tests: Mated Aquarius. Epson F80. Olivetti P101. List on Spectrum. Vic 20 assembler. Supergraph VectorSeries. **Gameplay:** Dealer support. Atari graphics. **Programs:** Krakit (ZX81). Cruising On Broadway (Spectrum). Kakias (Vic 20). Fantastic Voyage (ZX81). **Programs:** CBM controls. Computer Set Up (BBC). Wacky Racers (Oric). Julian Dates. **Databases:** Peripherals. **Microcopia:** Graphics part 2.

Issue 8, April 29-May 6.
Pro-Tests: Atari Home Files Manager. Kobra's Vic Star for the Vic 20. Hestecrest's Accounts for the Spectrum. Epson RX80 printer. NCR's Decision Mate V. Future Computer FX20. **Features:** Micronet. Compact programming on the T199-4A. **Gameplay:** Harvesters (Vic 20). Strategic Commander (Dragon 32). A first book of Micro Rhythms (BBC). Time of the Time/Money (Spectrum). **Programs:** Program Indexer (BBC B). CBM Database cards 1-4. **Databases:** software.

Issue 9, May 6-13.
Pro-Tests: Structured Basic on the Apple. Fiat Power on the Vic 20. Star DP150 printer. Dams and Interpol interfaces for Commodore. **Features:** BBC function keys. Atari word-processing part 1. **Gameplay:** Jungles of Intrigue (Oric). The Castle (Oric). Starship Command (BBC B). Dragon Trek. Newsworld (Spectrum). **Programs:** Lower case (Dragon 32). CBM database cards 5-6. **Microcopia:** Peripherals, wildcard search (MBasic). **Databases:** hardware.

Issue 10, May 13-20.
Pro-Tests: Infomast on Commodore 64. Dragon Mac. MC202 and MU2000 music synthesizers (Apple). Print directly coupled modem. Epson QX10. **Features:** ZX81 graphics part 1; Atari word-processing part 2. **Gameplay:** Rescue (Spectrum). Dictator (Spectrum). Roman Empire (Spectrum). Chopteur (Vic 20). Skyhawk (Vic 20). **Programs:** C. IBM. Jack (Lynx). Escape (Spectrum). CBM Database cards 7-9. Evaluate (MBasic). Formula (BBC B). **Databases:** peripherals. **Microcopia:** Graphics, part 5.

Issue 11, May 20-26.
Pro-Tests: BBC Vulfie. PFS-File for IBM. Apple Pascal; printer comparison. Pickard Joystick Controller for ZX81 and Spectrum. C'PM Computer Board. **Features:** ZX81 graphics part 2. Basic on the Sharp MZ20K. **Gameplay:** Motor Mania (Commodore 64). One Flight. BBC Music Synthesizer. Mads Maker (Spectrum). Embassy Assault (Spectrum). Tomb of Terror (Spectrum). **Programs:** Homeward Bound (ZX81). Connect Four (Dragon 32). CBM Database cards 10-12. **Databases:** keyboards.

Issue 12, May 27-June 3.
Pro-Tests: Spectrum word processor. PFS Report on IBM. File Handling for Colour Genie. CFI CP801. Printer. TG Trackball; Sord MS. **Features:** Epson Basic. Oric stand out graphics. Colour graphics. **Gameplay:** Mad Martha (Spectrum). Freasy (Spectrum). Headbanger (Spectrum). Tropic Island (Atari) control. Word processor (BBC B). **Databases:** hardware. **Clubnet:** clubs (Cambridge Microcopia). **Microcopia:** Disk Drives, part 1.

Issue 13, June 3-9.
Pro-Tests: Telewriter for Dragon 32. Aberforth Fort for Spectrum. GIP graphics processing system for Apple II+. joystick, rulers; Ayle. **Features:** Dragon meets Tandy. Supergraph 2 transferring Basic for Colour Genie and Genie. **Gameplay:** Everest Ascent (Spectrum). Colour Genie roundup. Micro Maze (Jupiter Ace). Oix (Atari). **Programs:** Cupid (Oric). Alien (Dragon 32). Time Bomb (Atari). **Databases:** peripherals.

Issue 14, June 10-16.
Pro-Tests: Apple Accelerator II board. Model 2 (Apple II). One-Base. Joystick Control Unit J6. Kempston Centronics Interface. BBC Speech Synthesiser. **Features:** Newbrain Basic part 1. Sirius designing. **Gameplay:** Ah Diddams (Commodore 64). Automopoli (Spectrum). Dragon dramatics. **Programs:** Time Bomb (Atari, cont). Sheep Drive (BBC B). **Databases:** software. **Microcopia:** Spectrum, Part 1.

Issue 15, June 16-22.
Pro-Test: Com 35. Address Manager (Spectrum). Syses (Commodore 64). MXT Database (Epson HX-20). Voice Input Module (Apple II). **Features:** Newbrain Basic part 2. Genie scene. **Gameplay:** Cleared for Landing. Playing the Ace (Apple II). Vultures. Star Jammer (Dragon 32). **Programs:** Mover (BBC B). Spryck Clock (Commodore 64). Pirate Island (Atari, 3 of 3). Micro-mind (Colour Genie). Brickbat (Dragon 32). **Databases:** Hardware. **Microcopia:** Spectrum, part 2.

Issue 16, June 23-29.
Pro-Tests: Atari Acorn, word processing for the Commodore 64. Simplitex (C'PM). MFP-II printer. Z80 keyboard for IBM. **Features:** ZX81 Maths. US mail offer. Atari graphics. **Gameplay:** Computer Scorable (Spectrum). Educator (BBC). Horace and Spiders (Spectrum). Ticha Snaitha (Vic 20). **Programs:** Cards: Video Tiler (T199-4A 3 of 6). Bowling (Spectrum). Pirate Island (Atari, cont). **Microcopia:** Spectrum, part 3.

Issue 17, June 30-July 6.
Pro-Tests: Duet-16. The Organizer (C'PM). Trace and ZX Text (Spectrum). Jaki 6100 daisywheel. Vides Ultra Term (Apple II). **Features:** Leasing part 1. Atari screen action. **Gameplay:** Oric chess. Grand Master (Commodore 64). Escape from Orion (BBC). Jet Pac (Spectrum). The Ring of Dragons (Dragon 32). Spectrum spectacle. **Programs:** Cards: Video Tiler (T199-4A 4 of 6). Pirate Island (Atari) cont. Word processor (BBC B). **Databases:** Sound, part 5.

Microcopia: Sound, part 5.

Issue 18, July 7-13.
Pro-Tests: Tandy 1000. R3232 interface (ZX81). ROM paper (Commodore). Interface printer buffer. IBM Personal Basic. Spectrum assembler. Newbrain WP. **Features:** Leasing part 2. Lynx music. **Gameplay:** Spectrum Backgammon. BBC Stooker. Commodore 64 round-up. Serpente (Vic 20). Post (Spectrum). Spectrum Safari. **Programs:** Word Processor (BBC). Fruit Machine (Spectrum). **Microcopia:** Sound Part 2.

Issue 19, July 14-20.
Pro-Tests: 16-bit chips. Stock control (Epson HX20). Maltipus (Torch). Smash Corona daisywheel. ZX81 word processing. **Features:** Insurance, buying second-hand. **Gameplay:** Escape MCP (C64). Escape from Perilous (Atari). Apple round-up. Temple of Aphai (C64). Airline (Spectrum). Health-rod (Spectrum). **Programs:** Cards: Colour Code (Atari). Wreck (Dragon 32). **Microcopia:** Sound, part 3.

Issue 20, July 21-27.
Pro-Tests: Rade hardware. Vic digital tape drive. Seikosa colour printer. Toolkit (Spectrum). Bonus (Pet payroll). Newbrain monitor. **Features:** Computer art. Dragon scrolling. **Gameplay:** Rabbit Trail (T199-4A). Aztec Challenge (Atari). Vic 20, T199-4A. BBC round-up. Joost (Spectrum). Molar Mail (Spectrum). Print Shop (Spectrum). Time-Lords (BBC). **Programs:** Tumbler (Oric). Wreck (Dragon). Atari Errors Speed Race (Vic 20). **Microcopia:** Sound, part 4.

Issue 21, July 28-August 3.
Pro-Tests: Graphics. Newbrain assembler. BBC turtle. Oric printer. Triumph printer. **Gameplay:** Commodore 64 (Dragon). Hammer House of Horror (Spectrum). Jumpman (64). Jump. Jack (Spectrum). Fourth Encounter (Vic). Cyclons (64). **Programs:** Cards: Collection (Vic). Bomber (64). Definer (BBC). **Microcopia:** Sound, part 5.

Issue 22, August 4-10.
Pro-Tests: Spectrum. Frob. BBC graphics. Music synthesizers. IBM Modem. Printer daisywheel. Maltro keyboard. Mupid. **Features:** Genie assembler. Dragon machine code. **Gameplay:** River Rescue (Oric). Attack (Atari). Zerk's Kest in 3D. 3D Combo Zone (Spectrum). Moria (Oric). Velpor's Lair (Spectrum). **Microcopia:** C'PM part 1.

Issue 23, August 11-August 17.
Pro-Tests: Sord Basic 6. Tawford. BBC microtoppings. Microdrive. Tandy graphics case. **Features:** Dragon machine code. Atari controller. **Gameplay:** Bridge Master. Strix. Matic Miners (Spectrum). Atari round-up. Candy Floss/Hangman (Oric). Everest (Dragon 32). **Microcopia:** C'PM, part 2.

Issue 24, August 18-August 24.
Pro-Tests: T-Maker III. Spectrum Fifth. daisywheels surveyed. Spectrum 1000. Atari machine code. **Gameplay:** Videdex. Dragon machine code. **Gameplay:** Oric roundup. Cookle. Log Farm. Xadom (Spectrum). Sea Lord (BBC). Lusitania (Commodore 64). The Island (BBC). **Microcopia:** Commodore 64, part 1.

Issue 25, August 25-August 31.
Pro-Tests: Spectrum. Simons Basic. Oric monitors. Microdrive. **Features:** Newbrain map. Acorn BBS. Atari machine code. **Gameplay:** Suspended (64). Terror Dakitas. Tranz Am (Spectrum). Dragon. W. Racer. Jagger (Oric). Frogger (IBM). **Microcopia:** Commodore 64.

Issue 26, September 1-September 7.
Pro-Tests: Microtron 65. BCFPL. BBC tracer. 80 column Pet. Oric interfaces. **Gameplay:** Magic Mountain. Graphics Case (Spectrum). Sea round-up. Matrix (64). Ninja Warrior (Dragon). Dallas (Oric). Mole to Arms (IBM). **Microcopia:** Commodore 64.

Issue 27, September 8-September 14.
Pro-Tests: Sharp MZ700. BBC Lynx. Apple editor. IBM mic. ZX81 support. **Gameplay:** Zip-Zap. Zoom (Spectrum). Spectrum roundup. Hover Beaver. Beni-Japan Rescue (64). **Microcopia:** Dragon, part 1.

Issue 28, September 15-September 21.
Pro-Tests: Zenith Z100. Small Logo. Atari Supergraphics. Newbrain. IBM mic. **Gameplay:** The Witness. Super Scramble. Sita (64). Harrier Attack (Oric). Morocco Grand Prix (Dragon). Pharaoh's Tomb (Spectrum). **Microcopia:** Dragon, part 2.

Issue 29, September 22-September 28.
Pro-Tests: Portico Miracle. Dragon editor. BBC toolkit. Dragon drives. Apple light pen. **Features:** HX20 disassembles. TI transformations. **Gameplay:** Gadder. Gloopert. Morris Gosh (64). Oric roundup. Bomb Alley (BBC). General Election (Spectrum). **Microcopia:** Dragon, part 3.

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DATA BASES

This six-page guide lists as many of the micros on the market for under £12,000 as possible. In Databasics you'll find all the specifications for the machines, add-ons and software necessary to make your buying decisions.

PCN keeps you up to date in three-week cycles, starting with hardware, then peripherals and finally software.

PRICE Specifications listed for each machine indicate what you get for the basic price quoted, which includes VAT.

PROCESSOR TYPE microprocessor is the heart of the computer. The Z80 and 6502 are popular 8-bit chips. The 8088 and 68000 are common 16-bit chips. If a machine has an 8-bit and a 16-bit processor we have listed the 16-bit only. Cust. means custom-built.

SPEED IN MHz Speed of the clock used to drive the microprocessor, measured in MegaHertz (million cycles per second).

STANDARD RAM Amount of main memory used on the system. The capacity is expressed in kilobytes.

MAX RAM normally at extra cost Amount of memory to which the system can be expanded.

MAX CHARACTERS columns × lines The number of characters that can be displayed across the screen and the number of lines down.

METHOD (at extra cost) This indicates the way the computer displays information. **M** on its own means that a monitor is included in the basic price.

Tv indicates that you can plug the computer into a television set. **(M+)** indicates that the monitor costs extra. **LCD** = Liquid crystal display.

COLOURCAPABILITY tells you whether the machine can give colour at the basic price quoted.

MAX DOT RESOLUTION gives the maximum number of points across the screen by the number of points down the screen that are available for graphics.

KEYBOARD This tells you the type of keyboard that comes with the machine. **W** = word processing, **C** = calculator and **T** = touch-sensitive.

No OF FUNCTION KEYS refers to the number of keys that can be used for different jobs by different programs.

NUMERIC PAD indicates whether the machine has a separate calculator-style group of number keys to enter data quickly.

INTERFACES BUILT-IN shows the number of standard connections built into the machine.

CASSETTE FACILITY gives a yes or no as to whether or not the machine can use a cassette to store data.

CAPACITY PER DISK AND DISK SIZE tells you how many disk drives come with the machine, and the amount of data in kilobytes (K) or megabytes (Mb) that can be stored on each drive. There are two sizes for disks, 5¼" or 8", and they can be floppy (F) or hard (H).

OPERATING SYSTEM gives the program that looks after the general running of a computer.

LANGUAGES INC is a column which lists the programming languages that come with the machine at the basic price.

OTHER LANGUAGES AVAILABLE indicates whether or not other programming languages are available for the machine.

DISTRIBUTOR To find which company distributes the machine refer to the distributor table from the code listed in this column. The table is at the end of the listings, and gives the distributor's name and telephone number.

All details given are the latest available. We ask distributors to let us know as soon as machine specifications change so Databasics can be kept right up to date. This guide has been meticulously researched and the information collected from individual distributors listed.

PRICE GUIDE

Sinclair ZX81	£40	Datac/Micro Controller	£431	Televideo TS-800 Series	£1,495	Adler Alphatronic P2	£2,197	Britannia Baby	£2,657	Samurai	£3,214	Altos 800/15	£5,663
Casio PB100	£50	Powertan Cortex	£454	HP86A	£1,570	CountryCom 'ters C3000	£2,242	Adler Alphatronic P3	£2,696	Tiger	£3,214	Durango F85	£5,744
TRS-80 PC4	£50	EpsonHX20	£472	Osborne I	£1,581	Kemtron K2000E	£2,242	Corona PC1	£2,242	Torch	£3,214	Trinton 4	£5,744
Oric-1	£50	Tandy TRS80 Model 100	£499	Signet 10025	£1,599	Ray Black Box 320S	£2,242	Eagle II	£2,702	Future FX30	£3,230	SW Tech. Products SO9	£5,750
Laser 200	£70	Nascom	£549	APL Signet	£1,610	SanyoMBC 2000	£2,242	Almarc-801	£2,708	Tosh T223	£3,277	BSAF 7100	£5,805
Aquarius	£80	Commodore4016	£632	Basis 108	£1,683	Sanyo T-2000	£2,242	DEC Rainbow 100	£2,714	Kontron RS180	£3,306	CompuStar	£5,837
Sharp PC1251	£80	Research Machine 480Z	£650	Commodore Super. Ppr 9000C1	£1,719	TMK 332	£2,242	ICL PC Model 10	£2,754	Kaypro 10	£3,340	SordM243	£5,842
Jupiter Ace	£80	DARC	£662	Merlin Galaxy 2	£1,719	Merlin M2215	£2,242	Columbia PC 1600-1	£2,754	Sage IV	£3,392	Sage IV	£5,962
Sasio FK02P	£90	Apple II	£776	ACT Apricot	£1,719	Borsal SM3000	£2,294	Digico Prince	£2,754	Rair-Business Computer	£3,392	Rair-Business Computer	£5,937
Sinclair Spectrum	£99	Commodore 500	£799	Microsolution Brit. Genius	£1,840	CAL PC	£2,294	Victor 9000	£2,754	OEM Form	£3,392	SuperStar	£6,296
Tandy TRS-80 Pocket 2	£130	Tandy Model 4	£861	Globe 101	£1,850	SanyoMBC 1250	£2,294	North Star Advantage	£2,756	Barcelona AMT 100	£3,450	Rack 6000	£6,327
Commodore VIC 20	£140	HP 75C	£883	Grundy 8200	£1,850	Casu Minn C2	£2,300	Apple III	£2,780	Kalamazoo 1050	£3,450	TI System 200-250	£6,695
Atari 400	£149	Sharp MZ80B	£900	Genie III	£1,895	Seed System 1	£2,300	Sony S1	£2,817	Digital Microsystems 3	£3,576	Wicat 150	£6,846
Sord M5	£150	Franklin Ace	£914	Toshiba T-100	£1,900	Sharp PC3201	£2,300	Borsal SM 4000	£2,817	Corvus Concept	£3,594	Sundance I	£6,969
Atari 600XL	£160	Apple IIe	£972	Sord M23	£1,932	HP 85	£2,360	Logica Vites/Visite	£2,863	Televideo TS 1602-C	£3,714	Pascal Mod. Microengine	£7,003
Colour Genie	£160	Magic 320 GB	£978	Kaypro I	£1,949	HP Series 100, 120	£2,362	Decision-1 Computer O11	£2,869	Adds Multivision	£3,795	Apple Lisa	£7,653
Sharp PC1500	£169	Husky Hunter	£997	Krypton 800 range	£1,949	Sharp M23P	£2,369	Merlin M20	£2,869	Clenio	£3,795	Sundance II	£8,205
Dragon 32	£174	Commodore 8032	£1,129	Kenilworth 83G	£1,953	TI Prof. Computer	£2,386	DMS Fox	£2,875	Panasonic JDB00M	£3,795	Haywood Hinet	£9,550
Texas CC40	£180	Commodore 710	£1,144	Transam Truscan	£1,983	IBM PC	£2,392	Eagle III	£2,950	Kemtron K3000	£3,795	Altos 856-10	£9,631
Tandy TRS-80 colour	£180	Microdecision	£1,144	NCR Decision Mate V	£1,983	Xerox 820 Model II	£2,415	Zenith ZF-120-22	£2,978	DEC PC-350	£3,850	Sundance II	£10,480
Mattel Intellivision	£190	Duett 16	£1,150	Epson QX10	£1,995	Haywood 3000	£2,439	Monroe EC 8800	£2,980	Vector 4	£3,852	Spectrum	£11,442
Electron	£199	Tulip 1	£1,154	IDS Datamachine	£1,995	LSM4	£2,472	Philips P3500	£3,000	Cifer Club	£3,904		
Computers Lynx	£225	Fujitsu FMB	£1,195	Tandy TRS-80 Model II	£1,999	Canon CX-1	£2,500	Tanberg EC10	£3,003	Sage II	£4,019		
Dragon 64	£225	SanyoMBC 1000	£1,195	Kenilworth 83N	£2,012	Sirius 1	£2,525	Archives I	£3,003	Tandy TRS-80 Model 16	£4,199		
Commodore 64	£229	Pied Piper	£1,226	Caltech Micro	£2,019	IO Tech Iona	£2,539	Cromemco System 1	£3,025	IBM PCXT	£4,268		
Sharp MZ700	£250	Positron 900	£1,259	Minstrel	£2,059	HP 87XM	£2,571	Wang Professional	£3,076	Hitech H4500	£4,310		
Atari 800XL	£250	Tandy TRS-80 Model III	£1,299	Portico Miracle Portable	£2,064	Quantum 2000	£2,587	DECPC 325	£3,080	BMCOK 11F800, Model 20	£4,360		
New Brain A	£269	Cromemco C10	£1,350	LSIM3	£2,064	Canon AS100	£2,599	Direct 1000	£3,093	ADS 42	£4,500		
Genie II	£299	Commodore 8096	£1,454	Haydon 9000 Composite	£2,064	Apple IIe	£2,599	Equalizer	£3,099	Televideo TS-802H	£4,533		
Atari 800	£300	NEC PC 8001	£1,375	Research Machines 380Z	£2,147	Cy110	£2,639	Hyperion	£3,100	CountryCom 'ters C1000	£4,542		
Nascom 2	£327	Pasca 640	£1,437	Superbrain JR	£2,150	Seed System 19	£2,600	Clenio Table-Tops 925	£3,105	Micro Five 1000	£5,175		
Microtan 65	£369	NEC PC8000	£1,454	Future Computers FX-20	£2,156	Enterprise 1000	£2,645	ITT 3030	£3,105	Fortune 32:16 System 2	£5,204		
BBC Model B	£193	Signet	£1,437	C/WP Cortex	£2,179	Facit 6520	£2,645	HP Series 200 Model 16A	£3,211	Zeus	£5,400		
Sharp MZ80A	£399	Magnum	£1,489	Comart Communicator	£2,180	Olympia Boss Model A	£2,645	Cifer Series 1	£3,214	Molecular M200	£5,462		

ABBREVIATIONS

Ap: Apple
As: Assembly
Ba: Basic
Co: Cobol
Cm: Camal
Fr: Fortran
Ft: Fortran
Pa: Pascal

Make and model	Price £/US\$	Processor type	Speed in MHz	Standard RAM	Max RAM - normally at extra cost	Display		Graphics		Keyboard		Interfaces built-in				Storage	Operating system	Languages inc.	Other languages available	Distributor	Comments
						Max characters columns x lines	Method (at extra cost)	Colour capability	Max dot resolution	Type of keyboard	No. of function keys	No. of numeric pad	No. of RS232	No. of Centronics	No. of EEC 488						

HARDWARE

ACT Apricot	£1,719	8086A	5	256K	768K	80x25	LCD		800x400	W	8	1	1	2		2x315K3 1/4F	MSDOS	Ba	●	A7	PCN issue 37	
Adds Multivision	£3,795	8085A	5	64K	256K	80x25	M		640x240	W	28	1	1	1		1x350K5 1/4F	CP/M2.2, Moon	Ba	●	A2	Multi user system	
Adler Alphatronic P2	£2,197	8085A	3	48K	64K	80x24	M			W	6	●	2	1	3	2x320K5 1/4F	CP/M	Ba	●	T1	£327 buys extra storage	
Adler Alphatronic P3	£2,696	8085A	3	64K		80x24	M			W	6	●	2	1	3	2x290K5 1/4F	CP/M	●	T1	16 bit option-promised		
Ajile	£2,599	8088	4	256K		80x25	M		640x250	W	10	●	1	2		2x320K5 1/4F	MS-DOS	BaAs	●	A9	PCN issue 13	
Almarc 801	£2,708	Z80	4	64K	512K	80x25	(M+)	●		W	●	2	1	11		2x800K5 1/4F	CP/M	●	A4	8-bit range goes to 20Mb		
Aquarius	£68	Z80A	4	4K	52K	40x24	TV	●	320x192	C				1	●		Cassette	Ba	●	M7	PCN issue 7	
Altos 800/15	£5,663	Z80	4	192K	208K	80x24	M			W	8	●	1			1x450K5 1/4F	MP/M	●	L1	Multi user business machine		
APL Signet	£1,610	Z80A	4	64K		80x25	Tv(M+)	●				2				2x188K5 1/4F	APL, CP/M	Ap	●	M1	*APL terminal recommended	
Apple II	£776	6502	1	48K	128K	40x24	Tv(M+)	●	256x192	W				8	●		CP/M, DOS 3.3, UCSD-P	Ba	●	A8	Plenty of software and extras	
Apple Iie	£972	6502	2	64K	128K	80x24	(M+)	●	256x192	W			1	8	●		DOS	Ba	●	A8	Updated Apple II	
Apple III	£2,780	6502	2	128K	256K	80x24	(M+)	●	560x192	W		1		4		1x140K5 1/4F	SOS, DOS	●	A8	Will emulate Apple II		
Apple Lisa	£9,775	68000	8	1Mb		120x30	M		792x360	W	●	2	1	3		2x860K5 1/4F	Lisa	●	A8	PCN issue 1		
Archives I	£3,003	Z80	4	64K		80x25	M		240x100	W	23	●	2	1	5		2x386K5 1/4F	CP/M	●	S1	Standard CP/M + graphics	
Atari 400	£150	6502B	1.79	16K		40x24	Tv	●	320x192	T	3			7	●		Cassette	Ba	●	A5	Games computer	
Atari 800	£300	6502	1.8	48K		40x24	Tv(M+)	●	320x192	W	3			7	4	●		Cassette	Ba	●	A5	Versatile, good graphics
Atari 600XL	£160	6502C	1.79	16K	64K	40x24	(M+)Tv	●	320x192	W	5			4	1	●	1x127K5 1/4F	DOS 2	Ba	●	A5	Dos 3 available 1984
Atari 800XL	£250	6502C	1.79	64K		40x24	(M+)TvM	●	320x192	W	5			4	1	●	1x127K5 1/4F	DOS 2	Ba	●	A5	256 colours, 128 at any one time
Barcellos AMT 100	£3,450	Z80A	4	64K	256K	80x24	TvM			W	8	●	1	1	2	3	2x500K8F	CP/M	BaCo	●	B1	Up to four users
BASF 7100	£5,805	Z80A	4	64K		80x24	M			W	26	●	1	1			3x163K5 1/4F	BOS	Ba	●	C1	Hard disk promised
Basis 108	£1,683	6502	1	64K	126K	80x24	TvM	●	820x168	W	15	●	1	1	6	●			●	C12	Apple bus, Z80, 80 columns	
BBC Micro Model B	£399	6502	2	32K		80x30	Tv(M+)	●	640x256	W	10			1	5	3	●	MOS	BaAs	●	A1	PCN issue 3
BMC OKI 800, Model 20	£4,360	Z80B	5	64K	256K	80x25	M	●	640x200	W	15	●	1		●		2x340K5 1/4F	CP/M	Ba	●	E1	Built-in printer
Bonsai SM 3000	£2,294	Z80	2	64K		80x24	M		80x24	W	14	●	1	1			2x350K5 1/4F	CP/M	●	B2	CP/M business machine	
Bonsai SM 4000	£2,842	8088	5	128K	256K	80x24	M			W	14	●	1	1			CP/M, MP/M, MS-DOS	●	B2	Z80 for 8 bit software		
Britannia Baby	£2,657	8085	6.14	64K		80x25	Tv(M+)	●	80x25	W	11	●	2	1			2x500K5 1/4F	CP/M	AsBaCo	●	B3	C801 language included
British Micro Mini 803	£1,490	Z80A	4	64K		80x25	(M+)	●	512x256	W	17	●	1	1	1		2x400K5 1/4F	OS/M	●	B4	This is CP/M compatible	
CAL PC	£2,294	8088	5	128K	256K	80x25	TvM	●	256x192	W	●	2	1	1	5		2x400K5 1/4F	CP/M	Ba	●	C3	Also Z80B Processor
C-Base 64A	£401	6502	1	64K	192K	40x24	Tv(M+)	●	256x192	W	51	●		8	●		CP/M, DOS 3.3, UCSD-P	Ba	●	W3	Apple II compatible	
Caltext Micro	£2,019	Z80A	4	64K	256K	80x24	TvM			W	36	●	1	1	3		2x400K5 1/4F	CP/M	●	C3	Range of software included	
Computers Lynx	£225	Z80A	4	48K	192K	40x24	Tv(M+)	●	248x256	W	40	●	3	1	1	●		CP/M	Ba	●	C5	Also 128K with CP/M
Canon AS100	£2,633	8088	4	128K	512K	80x25	M	●	640x400	W	12	●		1	4		2x640K5 1/4F		●	C4	Choice of CP/M86 or MS-DOS	
Canon CX-1	£2,500	8088	4	128K	256K	80x24	M	●	80x25	W	15	●	3	1	2		2x320K5 1/4F	MCX	BaAs	●	C4	Pascal, Fortran as extras
Casio FX 702P	£90	Cust.		2K		20x1	LCD			C								Cassette	Ba	●	C6	Pocket computer
Casio PB100	£50	Cust.		0.7K	1.7K	60x1	LCD			C	●							Cassette	Ba	●	C6	Business pocket computer
Casu Mini C Mark 2	£2,300	Z80A	4	64K			(M+)						4	1	6		2x1Mb8F		●	C7	*Choose your own terminal	
Cifer Series 1	£3,214	Z80	4	128K	320K	132x32	TvM			W	40	●	3	1			2x800K5 1/4F	CP/M	●	C17	Other models available	
Cifer Club	£3,904	Z80A	4	64K	256K	80x24	M		1024x300 opt	W	20	●	3	1	1		1x800K 5 1/4F	CP/M, MP/M opt, UNIX opt	●	C17	Optional 68000 processor	
Cienlo Pronto	£3,795	Z80A	4	64K	1Mb		Tv(M+)	●					2	2	18		2x600K8F	CP/M	Ba	●	C8	*Choice of terminal
Cienlo Table-Top 925	£3,105	Z80A	4	64K	128K	80x25	M			W	11	●	2	2			2x600K8F	CP/M	●	C8	Watch out for the weight	
Columbia PC1600-1	£3,392	8088	4.77	128K	1Mb	80x24	M	●	640x200	W	10	●	2	1	8		2x320K5 1/4F	CP/M, MS-DOS	Ba	●	I1	An IBM lookalike
Commodore VIC 20	£140	6502	1	5K	32K	22x23	Tv(M+)	●	176x158	W	8			3	1	●		Kernal	Ba	●	C9	Very popular home micro
Commodore 64	£229	6510	1	64K		40x25	Tv(M+)	●	320x200	W	8			3	1	●		Kernal	Ba	●	C9	PCN issue 24
Commodore 4016	£632	6502	1	16K	32K	40x25	TvM			W	●			1	1	3	●	Cassette, PETDOS	Ba	●	C9	The original PET
Commodore 700	£1,144	6509	2	128K	896K	80x25	TvM			W	10	●	1	1	2	1	●	Kernal	Ba	●	C9	PCN issue 5
Commodore 8032	£1,129	6502	1	32K	96K	80x25	TvM			W	●			1	1	●		Cassette, PETDOS	Ba	●	C9	The 80-column PET

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM ... normally at extra cost	Display		Graphics	Keyboard		Interfaces built-in				Storage	Operating system	Language inc	Other languages available	Distributor	Comments
						Max characters columns x lines	Method (at extra cost)	Colour capability	Max dot resolution	Type of keyboard	No. of function keys	Numeric pad	No. of RS232	No. of Centronics						

HARDWARE

Commodore Super Pet 9000	£1,719	6502	2	96K		80x25	TvM		W	●	1	1	1	2		Cassette, PETDOS	Ba	●	C9	Top of the range	
CompuStar	£5,837	Z80A	4	64K		80x25	M		W	●	2				1x10Mb8H+1x350K5¼f	CP/M	Ba	●	I10	Networking system	
Comart Communicator CP100	£2,180	Z80	4	64K	512K	80x24	M		W	●	2	1	10		2x390K5¼f	CP/M	●	C13	Business CP/M machine		
Corona PC1	£2,697	8088	5	256K	512K	80x24	M	●	640x320	W	1	1	1		2x144K5¼f	CP/M	Ba	●	N1	Price includes twin disk drive	
Corvus Concept	£3,594	68000	8	256K	1Mb	120x60	M		720x560	W	10	2	1	4		Merlin	Pa	●	K1	A4 shaped screen	
Country Computers C1000	£4,542	6502	1	64K	128K	80x24	M		280x192	W	12	1	1	3	1x10Mb5¼H+1x140K5¼f	DOS, CP/M	Ba	●	C16	Runs all Apple software	
Country Computers C3000	£2,242	Z80A	4	64K	256K						1	1		1x5Mb5¼H+1x500K5¼f	CP/M	●	C16	Terminal own choice			
CP1100	£2,639	8086	6	128K	1Mb		(M+)*				2	1		2x390K5¼f	CP/M 86	●	C13	Choose your own terminal			
Cromemco System 1	£3,025	Z80	4	64K		80x24	(M+)	●	450x735	W	20	1		8	2x390K5¼f	CDOS, Crom	●	C13	Upgrades available		
Cromemco C10	£1,350	Z80	4	64K		80x25	M		80x25	W	2	1			1x390K5¼f	CP/M	Ba	●	C18	Low cost CP/M machine	
CWI Cortex	£2,179	Z80	4	64K		80x25	M		600x240	W	10	1			2x360K5¼f	CP/M	Ba	●	C20	Z80 plus 6502	
DAL PC	£684	8080	2	48K		60x24	Tv(M+)	●	255x335	W	1					Cassette	Ba	●	D9	Optional maths chip	
Datasc Micro Controller	£431	Z80	2	16K		40x24	Tv(M+)		80x60	W	1	1					Ba	●	D1	Mainly used in labs	
DEC Rainbow 100	£2,714	8088	N/A	64K	192K	132x24	M		960x240	W	20	2		3	2x400K5¼f	CP/M	●	D2	Versatile business machine		
DEC PC 325	£3,080	PD11/23	N/A	256K		132x24	M	●	960x240	W	20	2		1	2x400K5¼f	P.I.OS	●	D2	Mini in micro clothing		
Decision-1 Computer MDC-011	£2,869	Z80A	4	64K	192K		(M+)*				3	1		1	2x400K5¼f	CP/M	Ba	●	I2	"Buy your own terminal"	
Digico Prince	£3,392	Z80A	4	64K		80x25	M			W	50	2		7	2x400K5¼f	CP/M	●	D3	Unusual keyboard		
Digital Microsystems DMS-3	£3,576	Z80A	4	64K			(M+)*				3	1			2x512K8f	CP/M	●	D4	"Choice of terminal"		
Direct 1000	£3,093	Z80	4	64K		80x25	M		132x28	W	2				2x300K5¼f	CP/M	●	D5	Standard CP/M machine		
DMS Fox	£2,875	Z80A	4	64K		80x24	M			W	16	3	1		1.2Mb5¼f	CP/M	●	D4	Portable machine		
Dragon 32	£174	6809E	1	32K	64K	32x16	Tv(M+)	●	256x192	W	1	4		1		Cassette	Ba	●	D6	Tandy colour lookalike	
Dragon 64	£225	M6809	0.89	64K		32x16	Tv(M+)	●	256x192	W	2	4			1x175K5¼f	OS9	Ba	●	D	PCV issue 39	
Duet 16	£1,144	8086	8	128K	512K	840x400	(M+)	●	640x400	W	12	2		4	1x720K5¼f	MS, DOS, CP/M	Ba 86	●	L7	Portable business	
Durango F85	£5,744	8085A	5	64K	196K	80x64	Tv(M+)			W	4	1	12		2x1Mb5¼f	Star Basic	BaCo	●	C3	Built in printer	
Eagle II	£2,702	Z80A	4	64K		80x24	M		80x24	W	2	1		1	2x500K5¼f	CP/M	Ba	●	M3	Upgrades available	
Electron	£199	6502	2	32K		80x32	Tv(M+)	●	640x256	W	10					MOS	BaAs	●	A1	Excellent beginners' machine	
Enterprise 1000	£2,645		8	64K			M			W	10	2		2	2x358K5¼f	Enterprise	●	D7	Micro Nova 16-bit		
Epson HX20	£472	6301	1	16K	32K	20x4	LCD		120x32	W	13	2		2		Cassette	Ba	●	E2	Powerful portable	
Epson QX10	£1,995	Z80	4	192K	256K	80x25	M		640x400	W	18	1		5	2x320K5¼f	CP/M	Ba	●	E2	Expansion required for Valdoci	
Equator	£6,842	Z80A	4	64K	448K	80x24	M		255x560	W	14	7	1	1	1x5Mb5¼f+1x750K5¼f	CP/M, MP/M, Turbo DOS	Ba	●	E3	Two bigger models available	
Facit 6520	£2,645	Z80	4	64K	128K	80x24	M		80x24	W	8	2			2x320K5¼f	CP/M, Facit DOS	Ba	●	F1	Concurrent printing	
Fortune 32-16 System 2	£5,204	68000	6	256K	1Mb	80x24	M	●	1024x1024	W	16	1		20	2x800K5¼f	Unix	●	I3	Geneure 16-bit		
Franklin Ace 1000	£914	6502	1	64K	128K	40x24	M, Tv	●	256x192	W	1	4	1		2x140K5¼f	opt CP/M	Ba	●	C15	Apple IIe compatible	
Fujitsu FM8	£1,150	6809	1	64K		80x25	(M+)	●	640x200	W	10	1	4	1		Flex	Ba	●	S2	Good for business graphics	
Future Computers FX-20	£2,156	8088	8	128K	1Mb	80x25	M		800x400	W	20	2			2x800K5¼f	CP/M 86, MS-DOS	●	E1	Business micro, runs CP/M		
Future FX-30	£3,220	8088	8	128K	1Mb	80x25	M	●	1,280x500	W	30			2	1x8005¼f+1x5Mb5¼f	CP/M86, CP/M80 emulator	●	E1	Hard disk version		
Genie II	£299	Z80	1.7	16K	48K	64x16	Tv(M+)		128x48	W	4	1		1		Cassette	Ba	●	L2	Speeded-up Genie I	
Genie III	£1,897	Z80A	3.2	64K		80x24	M		160x72	W	8	1	1	3		New DOS	Ba	●	L2	CP/M costs extra	
Colour Genie	£168	Z80	2.2	32K		40x24	Tv(M+)	●	160x96	W	8	1	1	2		Cassette	Ba	●	L2	Home games machine	
Gemini Galaxy 2	£1,719	Z80	4	64K	512K	80x25	M		160x75	W	10	1	1	5		2x400K5¼f	CP/M	●	G1	Low cost British system	
Globe 101	£1,850	8085	3	64K		80x24	M		80x24	W	20	3			2x325K5¼f	CP/M	●	G4	Wordstar plus Mail Merge inc.		
Grundy 8200	£1,850	Z80	4	64K	256K	80x24	M		160x70	W	10	1			2x390K5¼f	CP/M	●	C19	Software included		
Haywood 9000 Composite	£2,064	Z80A	4	64K	192K	80x25	M		64x255	W	34	2		8	2x320K5¼f	CP/M	As	●	H1	Designed for network	
Hitachi PC1	£2,985	8088	5	320K	576K	80x25	M		640x200	W	10	1	1	2	5	2x320K5¼f	MS DOS	Ba, As	●	H6	Will be Pro-Tested, Issue 44

HP 75C	E883	Cust.	N/A	16K	24K	32x1	(M+)		C		1	4	●	1.3K card reader	HP	Ba	H2	Calculator/computer			
HP 85	£2,360	Cust.	N/A	16K	32K	32x20	M	255x191	W	8	●	1	1	4	●	Cassette	Ba	●	H2 Engineers' machine		
HP 86A	£1,570	Cust.	N/A	64K	512K	80x24	M	544x240	W	14	●	1	1	2	4	●	HP	Ba	●	H2 CP/M optional	
HP 87XM	£2,571	Cust.	N/A	128K	640K	80x24	M	544x240	W	14	●	1	1	1	3	4	●	HP DOS	Ba	●	H2 Special technical uses
HP Series 100, 120	£2,362	Z80A	3.68	64K		80x24	M	80x24	W	8	●	2		1		●	CP/M	Ba	●	H2 Top end HP business system	
HP Series 200 Model 16A	£3,212	68000	8	128K	750K	80x25	M		W	5	●	1		1	2	●	HP	Ba	●	H2 Genuine 16-bit	
Husky Hunter	£997	NSC800	4	80K	208K	40x8	LCD	240x64	C	8	●	1				●	CP/M	Ba	●	D10 Waterproof, with metal case	
	£3,100	8088	4.7	256K		80x25	M	320x200	W	10	●	1		1		●	1x320K5¼F	MS, DOS, CP/M 86	BaAs	●	G5 Same as Ajile
Hytch H4500	£4,310	Z80	4	64K	208K	80x25	M	80x25	W	26	●	1		3		●	2x403K5¼F	CP/M	Ba	●	H3 Standard CP/M micro
IBM PC	£2,392	8088	4.7	64K	576K	80x25	(M+)	640x200	W	10	●	1		5		●	1x360K5¼F	MS-DOS	Ba	●	I9 Slow but reliable
IBM PCXT	£4,258	8088	4.77	128K	640K	80x25	(M+)	350x720	W	12	●			8		●	1x10Mb5¼H	DOS 2	Ba	●	I9 8087 co-processor possible
ICL PC Model 10	£2,754	8085	3	64K	256K	80x24	Tv(M+)		W	11	●	2		8		●	2x700K5¼F	CP/M	Ba	●	I4 Bottom of range
ICL PC Model 15	£2,702	8085A	5	64K	512K	80x25	M		W	●	8					●	1x13.3Mb5¼H	CP/M, MPM	Ba	●	I4 Suitable for small business
IDS Datamachine	£1,995	Z80	4	64K	1Mb		Tv(M+)							15		●	2x400K5¼F	CP/M	Ba	●	I8 "Depends on terminal"
IO Tech Iona	£2,539	Z80	4	69K	960K	80x24	M	160x75	W	12	●			8		●	2x400K5¼F	CP/M	Ba	●	I5 Good colour versatility
Intellivision + micro adaptor	£189.90	CP1610	2.4	5K	20x12	Tv		160x96	C					1		●		Cassette	Ba	●	M7 Computer adaptor is £89.95
ITT 3030	£3,105	Z80A	4	64K	256K	80x24	Tv(M+)	80x24	W	8	●	1		1		●	2x280K5¼F	CP/M, BOS	Ba	●	I7 Top end business system
Jupiter Ace	£90	Z80	3.25	3K	51K	32x24	Tv(M+)	64x46	C					1		●			Fr	J1	Native Forth machine
Kalamazoo 1050	£3,450	8085	6	64K	80x24	Tv(M+)		80x24	W	10	●	1				●	2x250K5¼F	Kalamazoo	Ba	●	K3 Only Kabi language
Kaypro II	£1,949	Z80	4	64K	80x24	M			W	●	1	1				●	2x200K5¼F	CP/M	Ba	●	C15 PCN issue 35
Kaypro 10	£3,340	Z80A	4	64K	80x24	M		100x160	W	●	1			2		●	1x10Mb5¼H	CP/M	Ba	●	C15 PCN issue 35
Kemtron K2000E	£2,242	Z80	4	64K	80x24	(M+)		80x24	W	2	●	1		11		●	1x300K5¼F	CP/M	Ba	●	K4 Scientific Keyboard
Kemtron K3000	£3,795	Z80	4	64K	256K	80x24	(M+)	80x24	W	●	2			14		●	2x1Mb8F	CP/M, MPM	Ba	●	K4 For scientific use
Kenilworth 83G	£1,953	Z80A	4	64K	80x25	TvM		160x75	W	10	●	1		5		●	2x350K5¼F	CP/M	Ba	●	K5 British portable
Kontron RSI 80	£3,306	Z80	4	64K	128K	80x25	M	256x512	W	16	●	2		1	8	●	2x303K5¼F	Kontron	Ba	●	K6 O/S CP/M based
Krypton 800 range	£1,949	Z80A	4	64K	256K	80x24	M	80x24	W	13	●	2		1	8	●	2x386K5¼F	CP/M	Ba	●	T8 Fully definable characters
Laser 200	£70	Z80A	3.6	4K	64K	32x16	Tv	32x16	C	●				1		●			Ba	●	C14 Cheap colour computer
LSI M3	£2,064	Z80	2.5	64K	80x24	M		80x24	W	31	●	1		1		●	2x200K5¼F	CP/M	Ba	●	L3 Big, British and CP/M
LSI M4	£2,472	8088	5	128K	256K	80x24	M	160x72	W	31	●	2		1		●	2x400K5¼F	CP/M 86, CP/M80	Ba	●	L3 Z80 for 8-bit software
Logica VTS Vitesse	£2,863	8086	5	64K	256K	80x24	M	640x288	W	12	●	1		4		●	2x1Mb5¼F	CP/M, MS-DOS	Ba	●	L4 High-res colour graphics
Magnum	£1,489	Z80	4	64K	80x25	M			W	●	2					●	2x400K5¼F	CP/M	Ba	●	I6 Inexpensive CP/M machine
Merlin M2215	£2,742	8085	5	64K	24x80	M			W	22	●			2		●	2x780K5¼F	CP/M	Ba	●	B7 Business computer
Micro Five 1000	£5,175	8088	8	128K	512K	25x80	TvM	512x512	W	20	●	1		2		●	2x1Mb5¼F+2x6.3Mb5¼H		Ba	●	F2 "Choose your own O/S"
Microdecision	£1,144	Z80	4	64K	80x24	(M+)						2				●	1x200K5¼F	CP/M	Ba	●	M9 "Terminal extra"
Microslution British Genius	£1,840	Z80	4	64K	80x24	TvM		80x24	W	21	●	1		1		●	2x160K5¼F	CP/M	Ba	●	M4 Genus' by nature?
Microtan 65	£389	6502	1	8K	48K	25x64	(TvM+)		W	●	1	2		1		●	Tanbug	Ba	●	M8 PCN issue 26	
Milbank SX10	£2,754	Z80A	4	65K	256K	80x25	M	80x25	W	10	●	2		1		●	2x350K5¼F	CP/M	As	●	M5 Scientific applications
Minstrel	£2,059	Z80	4	64K	352K							2		1		●	2x400K5¼F	CP/M opt	Ba	●	H4 Choose your terminal
Molecular M200	£5,462	Z80	4	64K	320K		(M+)					2		1	16	●	1x10Mb8H+1x500K8F	CP/M	BaAs	●	G2 "Terminal required"
Monroe EC8800	£2,990	Z80A	3	128K	40x24	M	240x240	240x240	W	32	●	3		3		●	1x320K5¼F	Monroe	BaPaPilot	●	F3 Only 40-character screen
Mupid 320-GB	£978	Z80A	4	64K	128K	40x24	Tv(M+)	320x240	W	55	●			1	2	1	●		BaAs	●	P6 PCN issue 22
Nascom 2/3	£327	Z80A	4	2K	64K	16x48	Tv(M+)	48x96	W	●	1			4		●		NAS, SYS	BaAs	●	L5 Old reliable
NCR Decision Mate V	£1,983	Z80A	4	64K	512K	24x80	M	640x400	W	20	●			7		●	2x320K5¼F	CP/M 80	As	●	N3 PCN issue 8
NEC PC8000	£1,454	Z80	4	32K	64K	80x25	M	160x100	W	10	●	2		1		●	2x300K5¼F	CP/M 80, DEC, DOS	Ba	●	N1 Superb colour graphics
NEC PC8001	£1,375	Z80A	4	64K	80x24	M	100x200	100x200	W	10	●			1		●	2x144K5¼F	CP/M	Ba	●	N1 Price includes twin disk drive
Newbrain A	£269	Z80A	4	32K	512K	80x30	Tv(M+)	640x220	C	●	2			1		●		Cassette	Ba	●	G3 A lot of promise
North Star Advantage	£2,766	Z80	4	64K	80x24	M	640x240	640x240	W	15	●	1		6		●	2x360K5¼F	CP/M	Ba	●	T9 16-bit option
OEM Orion	£3,392	8086	8	128K	896K	80x25	TvM	800x400	W	13	●	11		6		●	2x500K5¼F	CP/M 86	BaCo	●	O5 "Full communications machine"
Olivetti M20	£2,869	28000	3	160K	512K	80x25	M	512x256	W	●	1			5		●	2x320K5¼F	PCOS	Ba	●	B6 Regular 16-bit
Olympia Boss Model A	£2,645	Z80A	4	64K	80x28	M	80x28	80x28	W	10	●	1		4		●	2x140K5¼F	CP/M	Ba	●	O1 Useful 28 lines on screen
Oric 1	£80	6502A	1	16K	48K	40x28	Tv(M+)	240x200	C	●				1	1	●		Cassette	Ba	●	O2 4-colour printer opt
Osborne 1	£1,581	Z80	4	64K	104x24	M	104x24	104x24	W	10	●	1		1		●	2x185K5¼F	CP/M	Ba	●	O3 Portable, includes software
Panasonic JD 800M	£3,795	8085A	4	60K	80x24	M	80x24	80x24	W	21	●	3		1		●	2x250K8F	CP/M	Ba	●	P1 Larger model costs £5,002
Pasca 640	£1,437	Z80A	4	64K	80x24	M			W	●	1			1		●	2x250K8F	CP/M	Ba	●	W1 Regular CP/M micro
Pascal Modular Microengine	£7,003	WD9000	2	128K			*	*				4		8		●	2x1.2Mb8F	UCSD-P	Pa	●	P2 "Terminal extra"

Make and model	Price inc VAT	Processor type	Speed in MHz	Standard RAM	Max RAM - normally in extra cost	Display		Graphics	Keyboard	Interfaces built-in					Storage	Operating system	Languages inc	Other languages available	Distributor	Comments	
						Mix characters columns x lines	Method (if extra cost)			Colour capability	No. of ports	Type of keyboard	No. of function keys	Numeric pad							No. of RS232
Pied Piper	£1,226	Z80A	4	64K		80x24	Tv(M+)		W 36					1x780K5¼f	CP/M			S11	PCN issue 4		
Philips P3500	£3,000	Z80A	4	64K	320K	80x25	M		W 11	●	2	1	1	2x0.6Mb5¼f	Turbo-DOS	Co	●	P3	Fast O/S as standard		
Portico Miracle Portable	£2,064	Z80A	4	128K	256K	80x25	M	640x250	W 10	●	2	1	5	2x400K5¼f	CP/M		●	P7	PCN issue 28		
Poutron 900	£1,259	6809	1	64K	256K		(M+)		*	*	*	*	1	3	O/S 9			Ba	●	P4	"You choose your terminal"
Powertan Cortex	£454	9995	12	64K	1Mb	40x24	Tv(M+)	●	256x192	W 12	●	1						BaAs	●	M2	Mainly sold as £340 kit
Quantum 2000	£2,587	Z80A	4	64K	192K	80x25	M	160x75	W 18	●	1	1	5	3x860K5¼f	CP/M		●	Q1	Mono, low-res graphics		
Rair Black Box Model 3/20S	£2,242	8085	5	64K	256K	80x24	(M+)		*	*	2	8	2	1Mb5¼f	CP/M	Ba	●	R1	"VDU extra; many versions"		
Rair Business Computer	£6,037	8088	5	256K	1Mb	80x25	M		W 10	●	2	4	8	1x19Mb5¼H+1x1Mb5¼f	CP/M, PCDOS	Ba	●	R1	Hybrid 8/16 bit		
Rair 6000	£6,327	Z80	5	64K	256K	80x26	M	80x26	W 21	●	1	1	1	1x600K8F	CP/M		●	R2	CP/M languages available		
Research Machines 380Z	£2,147	Z80A	4	32K	56K	40x24	Tv(M+)		W	1	1	4	●	2x144K5¼f	CP/M	Ba	●	R3	Widely used in schools		
Research Machines Link 480Z	£650	Z80A	4	32K	256K	40x24	Tv(M+)		W 4	2	1	1	2	●	Cassette	Ba	●	R3	CP/Net version available		
Sage II	£4,019	68000	8	128K	512K		(M+)		*	*	2	1	1	2	2x640K5¼f	UCSD-P System	BaKsPaFn	●	T10	*Terminal extra	
Sage IV	£5,962	68000	8	128K	1Mb		(M+)		*	*	6	1	1	2	2x640K5¼f + 1x6MbH5¼f	UCSD-P System	PaSaFn	●	T10	*Terminal own choice	
Samurai	£2,754	8086	4.6	128K	768K	80x25	M	●	720x400	W 12	●	3	1	3	2x1.2Mb8F	MS DOS, CP/M 86		●	M6	High-res colour graphics	
Sanyo MBC 1000	£1,195	Z80A	4	64K	80x25	M		80x25	W 17	●	1	1		1x320K5¼f	CP/M	Ba	●	L1	Standard CP/M model		
Sanyo MBC 1250	£2,294	Z80	4	64K	80x40	M		640x400	W	●	1	1		2x640K5¼f	CP/M	Ba	●	L1	High-res graphics		
Sanyo MBC 2000	£2,242	8085A	5	64K	80x24	M		80x24	W 24	●	2	1	2	2x328K5¼f	CP/M	Ba	●	L1	Big disk model costs £3,622		
Sanyo MBC 4050	£2,817	8086	5	128K	512K	80x24	M		80x24	W	●	1	1	2	2x640K5¼f	CP/M 86	Ba	●	L1	Pseudo 16-bit	
Seed System 1	£2,300	6800	2	32K	64K	80x24	M	80x24	W 3	●	2	8		2x160K5¼f	DOS 68 Flex	Ba	●	S3	Ageing business machine		
Seed System 19	£2,600	6809	2	48K	1Mb	80x24	M		W 3	●	2	8		OS-9			●	S3	Latest from Seed		
Sharp MZ80A	£347	Z80	2	48K		40x25	M	80x50	W	●					Sharp Basic	Ba	●	S4	CP/M facility extra		
Sharp MZ80B	£900	Z80A	4	64K	80x25	M		320x200	C 10	●					Sharp Basic	Ba	●	S4	Unusual keyboard		
Sharp MZ700	£250	Z80A	4	64K	68K	40x25	Tv(M+)	●	80x50	W 5	●	1	2	1	●	Sharp	Ba	●	S4	PCN issue 27	
Sharp PC1251	£79.95	Cust	58	4.2K	LCD	24x1	C	18	W	1	●				Sharp Basic	Ba	●	S4	Pocket computer		
Sharp PC1500	£169	Cust	1.3	3.5K	11.5K	26x1	LCD	156x7	C 6	●	1	1	2	●	Cassette	Ba	●	S4	Optional 4-pen plotter		
Sharp PC3201	£2,300	Z80A	2.6	64K	112K	80x25	M	160x50	W 10	●		5		2x500K5¼f	Sharp Basic	Ba	●	S4	Powerful Sharp Basic		
Signet 10025	£1,599	Z80B	6	64K		80x24	M	●	512x512	W	●	2	1	1	2x200K5¼f	CP/M, Macros		●	S9	Choice of keyboards	
Signet 2	£1,483	Z80	4	64K		80x24	(M+)	●	512x256	W 18	●	2		2x200K5¼f	CP/M			S9	Multi-user system		
Sinclair ZX81	£40	Z80A	1K	16K	32x24	Tv	64x44	C							Cassette	Ba	●	S5	Sold a million		
Sinclair Spectrum	£99	Z80A	3.5	16K	48K	32x24	Tv	●	256x192	C					Cassette	Ba	●	S5	PCN issue 14		
Sirius I	£2,525	8088	5	128K	896K	80x25	M	800x400	W 7	●	2	1	4	2x600K5¼f	CP/M 86, MS DOS	Ba	●	A7	IBM style		
Sord M5	£1,150	Z80A	4	4K	16K	40x24	Tv(M+)	●	256x196	C		1	2	2	●	Cassette	Ba	●	S6	PCN issue 12	
Sord M23	£1,932	Z80A	4	128K	80x25	M			W 14	●	2	1	2	3	2x330K5¼f	Sord O/S, SB80	BaPips	●	S6	CP/M compatible	
Sord M23P	£2,369	Z80A	4	128K	80x25	Tv(M+)	●	640x200	W 14	●	2	1	2	2	2x290K3¼f	Sord O/S, SB80	BaPips	●	S6	Complete with suitcase	
Sord M223	£3,277	Z80	4	64K	80x25	M			W	●	2	4		2x350K5¼f	Sord O/S, SB80	BaPips	●	S6	Standard business machine		
Sord M243	£5,842	Z80	4	192K	80x25	M	●	640x400	W 15	●	4	1	4		2x1Mb8F	Sord O/S, SB80	BaPips	●	S6	Large and powerful	
SWTP SO9	£5,750	6809	2	256K	1.2Mb	80x24	M		W 15	●	1	1		2x1.5Mb5¼f	Flex, Unixflex		●	S7	Top end SWTP		
Spectrum	£11,442	68000	8	256K	4Mb		(M+)		*	*	4		16	2x720K5¼f	Mirage	Ap	●	M1	*As terminal		
Sundance I	£8,969	Z80A	4	64K	256K	132x24	M		W 4	●	1	1		●	1x7Mb5¼H	CP/M	Ba	●	T2	Ordinary CP/M machine	
Sundance II	£8,205	Z80A	4	128K	256K	132x24	M		W 4	●	1	1		●	1x7Mb5¼H	CP/M	Ba	●	T2	Middle-range Sundance	
Sundance 16	£10,480	Z8001	6	256K	1Mb	80x24	M		W	●	5	1		●	1x14Mb5¼H	BOS		●	T2	Tape backup for hard disk	
Superbrain J/R	£2,127	Z80A	4	64K	80x24	M		560x240	W	●	2	1	1		2x160K5¼f	CP/M	Ba	●	I10	Bigger models available	
Superstar	£6,296	Z80	4	64K	80x24	Tv(M+)		80x24	W	●	1	1	8	1x10Mb5¼H+1x400K5¼f	CP/M 80	Ba	●	B7	Includes hard disk		
Tandberg EC10	£3,000	8080A	2	64K	80x25	M			W	●	7			1x250K8F	CP/M, TOS	Ba	●	T3	Very early machine		
Tandy TRS-80 Model II	£1,999	Z80A	4	64K	256K	80x24	M	80x24	W 2	●	2	1		1x500K8F	TRS-DOS	Ba	●	T4	Big business machine		
Tandy TRS-80 Model III	£1,299	Z80A	2	48K	64x16	M		128x48	W	●	1	1	1	●	2x184K5¼f	TRS-DOS	Ba	●	T4	Standard TRS 80	
Tandy TRS-80 Model 16	£4,199	68000	8	128K	512K	80x24	M		W 2	●	2	1	1		2x1.2Mb8F	TRS-DOS	BaAs		T4	True 16-bit	

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							Method (at extra cost)	Colour capability	Max dot resolution	Type of keyboard	No. of function keys					

HARDWARE

Tandy TRS-80 Colour Computer	£180	6809E	1	16K	32K	32 x 16	Tv	●	256 x 192	W		1	1	1	●	Cassette	Ba	●	T4	Related to Dragon 32			
Tandy TRS-80 PC4	£50	Cust.	N/A	1/4K	1 1/2K	12 x 1	LCD		12 x 1	C	9					Cassette	Ba		T4	Low-cost pocket computer			
Tandy Model 4	£861	Z80A	2	16K	128K	80 x 24	M		80 x 24	W	10	1	1	1	●	2 x 187K5 1/4F	TRS DOS	Ba	●	T4	Floppies versions available		
Tandy Model 100	£499	8085	2.4	8K	32K	40 x 8	LCD		240 x 62	W		1			●		Ba		T4	Software built in			
Tandy TRS-80 PC2	£130	Cust.	1.3	2.6K	16K	26 x 1	LCD		156 x 7	C	6				●		Ba		T4	Plotter available			
Televideo TS-802H	£4,533	Z80	4	64K		80 x 24	M		80 x 24	W	15	2	1		●	1 x 256K5 1/4F + 1 x 7Mb5 1/4H	CP/M	Ba	●	C11	Recently upgraded		
Televideo TS-800 Series	£1,495	Z80A	4	64K		80 x 24	M		80 x 24	W	15	2	1		●		CP/M	Ba	●	C11	Standard CP/M machine		
Televideo TS 1602-C	£1,323	8088	5	128K	256K	80 x 24	M		576 x 424	W	15	2	1		●	2 x 256K5 1/4F	CP/M-86	Ba	●	C11	Graphics, but no colour		
Tiger	£3,214	Z80	4	62K	256K	80 x 24	M	●	512 x 512	W	10		1	1	3	2	●	2 x 1Mb5 1/4F	CP/M-86	Ba	●	H5	PCN issue 36
TI Professional Computer	£2,386	8088	5	64K	256K	80 x 25	M			W	12		1	1		●	1 x 320K5 1/4F	CP/M	Ba	●	T5	PCN issue 3	
Texas CC40	£180	Cust.	6K	18K	31 x 1	LCD			31 x 1	C	4				●		Ba		T5	Circuitry software available			
TI System 200-250	£6,695	9900	4	64K	80 x 24	M			80 x 24	W	12	1			●	1 x 5Mb5 1/4H	UCSD-P, PX10	Ba	●	T5	Bigger version available		
TMK 332	£2,242	8085A	5	64K	80 x 24	M			190 x 96	W	22	2	1	4		●	2 x 320K5 1/4F	CP/M	Ba	●	P5	'6502 I/O processor	
Torch	£3,214	Z80*	4/2	96K	80 x 30	TvM	●	640 x 256	150	15	1	1	4		●	2 x 400K5 1/4F	CPN	Ba	●	T6	CP/M compatible		
Toshiba T-100	£1,900	Z80A	4	64K	96K	80 x 25	TvM	●	640 x 200	W	8	1	1	1	2	●	2 x 256K5 1/4F	CP/M	Ba	●	O4	Pro test March 18	
Toshiba T-200	£2,242	8085	2.6	64K	80 x 24	M			80 x 24	W	15	1	1		●	2 x 256K5 1/4F	CP/M	Ba	●	O4	Standard CP/M machine		
Transam Truscan	£1,983	Z80A	4	64K	80 x 24	TvM		640 x 288	W	8	2	1	1	5		●	2 x 190K5 1/4F	CP/M	Ba	●	T7	S-100 machine	
Tricon	£5,744	Z80A	4	64K	160K	80 x 24	M			W	8	1	1	3		●	2 x 1.2Mb8F	MPSL-BOS	Ba	●	T11	Upgradable to Winchester disk	
Tulip 1	£1,150	8086	8	128K	896K	80 x 24	M	●	760 x 288	W	16	1	1	6	1	●	1 x 5.25K5 1/4F	CP/M	Ba	●	N2	IBM PC software compatible	
Vector 4	£3,852	8088	5	128K	256K	80 x 24	M	●	640 x 312	W	15	1	1	2		●	2 x 630K5 1/4F	CP/M, CP/M 86	Ba	●	A4	8-bit and pseudo 16-bit	
Victor 9000	£2,754	8088	5	128K	896K	80 x 25	M		800 x 400	W	7	2	1	4		●	2 x 600K5 1/4F	CP/M 86, MS-DOS	Ba	●	D8	Same as Sirius 1	
Wang Professional	£3,076	8086	8	128K	256K	80 x 25	M		800 x 300	W	16	1	1		●	2 x 360K5 1/4F	MSDOS, CP/M80, UCSDP	Ba	●	W4	8087 co-processor optional		
Wicat 150	£6,846	68000	8	256K	1.5Mb	80 x 25	M		400 x 300	W	20	2	1	1		●	2 x 616K5F	MCS	Ba	●	S10	Upgradable to 32 user system	
Wilkes YD8110	£4,025	8086	5	128K	896K	80 x 24	M	●	960 x 624	W	21				●	2 x 1.2Mb8F	CP/M 86	Ba	●	W2	Standard CP/M machine		
Xerox 820 Model II	£2,415	Z80A	4	64K	80 x 24	M			1024 x 512	W	2	2	2		●	2 x 160K5 1/4F	CP/M	Ba	●	R4	Powerful graphics		
Zenith ZF-120-22	£2,978	8088	5	128K	192K	80 x 25	M		640 x 225	W	18	2	1	1	5	●	2 x 320K5 1/4F	CP/M, MS-DOS, Z Basic	Ba	●	Z1	PCN issue 28	
Zeus 4	£5,400	Z80	4	64K	320K	80 x 25	(M-1)		80 x 25	W	11	10			●	1 x 6Mb5 1/4H + 1 x 250K5 1/4F	CP/M, Muse	As	●	M5	Designed as multi-user		

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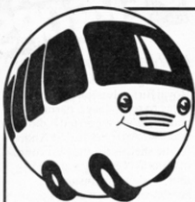
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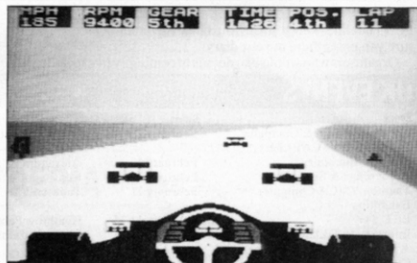
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Naturally you cannot steer a racing car effectively by pushing buttons or wiggling a joystick so we have developed a steering wheel that fits to the Spectrum. With one hand on the wheel (the other free for braking and accelerating) it gives the level of precision needed to steer the car on the fastest line through the corners and correct a skid when you overdo it. The wheel is strongly made and thanks to a brilliantly simple design we have been able to keep the cost down to a minimum. It will be used for many games in the future but is now only available with FORMULA ONE.

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Laughline

Scenes like this must be quite common up and down the country as the indomitable British find new ways to beat the freeze and get to work. What is actually happening is that an LSI Octopus is being used to log the scores in the Junior Ski championships held in Valliere, France, but you needn't let that distract you. What we are looking for is the funniest caption or comment, and we'll award £20 when the competition closes on February 22 — the winner to be announced in issue 51.



Mr J Thomas of London WCI wins £5 this week in the PCN Mispprints and Gibberish contest for spotting the possibility of looking at this clipping in two ways, '£2,000 is a large R & D investment???' he asks. Well we've all heard about cheap foreign labour.

Not so lots of loot



NEXT WEEK

Dragon drives — worth the wait? Judge for yourself from our cover feature.

Epson asides — more than one way to skin a cat with sideways printing.

Lynx out — Gridtrap listing for Lynx fans.

Proto-MSX — a full Pro-Test of Spectravideo's MSX-style micro.

Play away — games for the Spectrum, Commodore 64, and Vic 20.

Atari Special — The pull-out Micropaedia features an exclusive Pro-Test of the Atari 800XL and offers you a chance to win a 600XL.

SANTAX ERRORS

Golf game goof

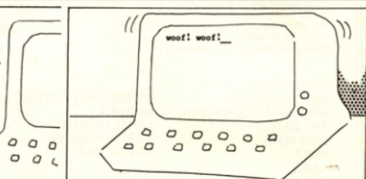
Ocean's golf simulation game Royal Birkdale is not the first such game to reproduce a particular course, as we suggested it did in issue 44. Artic has had St Andrews on the shelves for the past couple of months. Can anybody beat that? Is there an unsung Scarborough Pitch and Putt out there anywhere?

Memotech manual

Last week's article on the Memotech mentioned that the manual does not cover everything. This apparently includes the index, but fortunately you can get one free of charge from Microcell Computer Systems of Leeds. Just send a stamped addressed envelope to: Microcell Computer Systems of Leeds, 44 New Brigade, Leeds.

REAL-2000

by Mollusc



PCN DATELINES

PCN Datelines keeps you in touch with up-coming events. Make sure you enter them in your diary.

Organisers who would like details of coming events included in

PCN Datelines should send the information at least one month before the event. Write to PCN Datelines, Personal Computer News, 62 Oxford Street, London W1A 2HG.

UK EVENTS

Event	Dates	Venue	Organisers
Communications & Computer Systems Fair — CABLES 10th ZX Microfair	February 2-4	Pontin's, Prestatyn, Wales	Pontin's Ltd., 07456 2267
The Apricot & Sirius Show	February 4	Alexandra Palace, N22	Mike Johnstone, 801 9172
Taunton YMCA Computer Exhibition	February 7-9	Kensington & Chelsea Town Hall	Dennis Jarrett, 241 2448
LET 84	February 11	Taunton YMCA, Somerset	P. Wojcik, 0823 74667
Information Technology & Office Automation Exhibition and Conference	February 13-15	Heathrow Penta Hotel	Anthony Farrar, 0923 774262
OEM Only Conference	February 21-24	Barbican Centre, London EC1	B.E.D. Exhibitions Ltd., 01-647 1001
Computer Trade Show	March 7	Hilton Hotel, London W1	Tom Lewis, 01-994 6477
Scottish Computer Conference	March 13-15	Wembley Conference Centre, Middlesex	Reed Exhibitions, 01-643 8040
Essex Apple Village	March 13-15	Holiday Inn, Glasgow	Quadrilect, 01-242 8697
Computer Aided Design	March 25-28	Festival Hall, Basildon, Essex	Database Publications, 061-456 8383
	April 3-5	Met. Exhibition Hall	Reed Exhibitions, 01-643 8040

OVERSEAS EVENTS

Event	Dates	Venue	Organisers
Personal Business Computer Show	February 29-March 3	Hong Kong	Overseas Exhibition Services Ltd., 01-486 1951
Personal Computer Show	March 14-17	Sydney, Australia	ECL Ltd, 01-486 1951
International Business Equipment & Computer Show	March 13-17	Singapore	International Business Centre Co. Ltd., 8F Hosoi Building, 15-7, 5-chome Honmachi, Higashi-ku, Osaka, Japan

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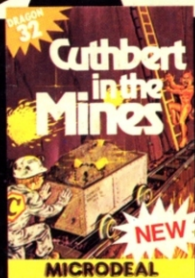
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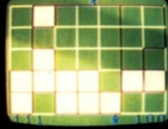
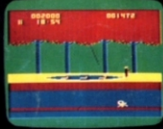
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